Electrical World
MARCH 6, 1943

TO A.Klaeson

Please make the following inspection called for by the maintenance schedule, and report in full the results of your work.

No.4 Boiler Feed Pump (500 G.P.M.)

4-Alignment-checking of, found coupling half on pump running 0.022 out of round with dial indicator due to shaft in pump slightly bent. Coupling half on motor end running 0.003 out of round. Lined up coupling halves best as possible due to conditions.

12-Bearings-Journal- In good condition.

20-Bearings-thrust-In good condition. end play 0.014

28 Casing-Internal examination of. In good condition

36-Coupling. Bolts and bushings in good condition

40- Foundation bolts. Tight.

REPORT { Describe the nature of repairs made; record quantity and kind of materials used, parts renewed, important dimensions and all information which may be valuable for future reference.

44-Impellers. In good condition, bored out inside of hubs of impellers to 2.518 in.

50-Oil chambers- Washed out and renewed oil.

60-Packing-Shaft- Renewed packing, 1/2 in.----- Make, 5 rings on thrust end, 7 rings on coupling end

70-Shaft-found shaft badly pitted. Machined and sprayed with ----- 11 gage B.& S., and machined shaft to size, 2.518 in way of hubs on impellers and shaft spacer bushings

[illegible] Shell. In good condition

[illegible]ller-Rings machined with----- and to size. Sketch [illegible]llers in way of wearing rings as found and left.

[illegible]dition.

CHIEF ENGINEER

MAINTENANCE WORK ORDER AND REPORT

TO No 4 B.F. Pump DATE July 24 to 42

Please make the following inspection called for by the maintenance schedule, and report in full the results of your work.

Clearances as found.

REPORT Describe the nature of repairs made; record quantity and kind of materials used, parts renewed, important dimensions and all information which may be valuable for future reference.

APPROVED FOR ENTRY

MAINTENANCE WORK ORDER AND REPORT

TO No 4 B.F. Pump DATE July 24 to 42

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Clearances as left.

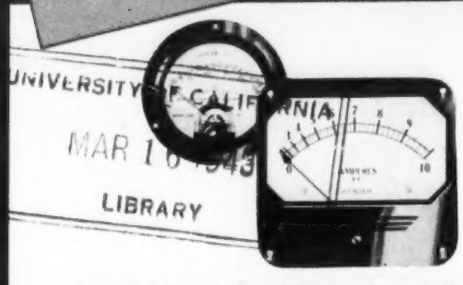
REPORT Describe the nature of repairs made; record quantity and kind of materials used, parts renewed, important dimensions and all information which may be valuable for future reference.

APPROVED FOR ENTRY

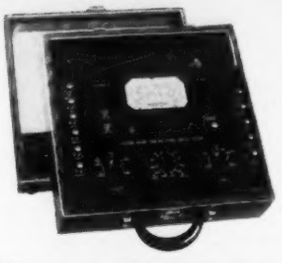
POWER PLANT MAINTENANCE SYSTEM STREAMLINED

FOR ELECTRONICS MEASUREMENTS, TOO,

the Standards are Weston

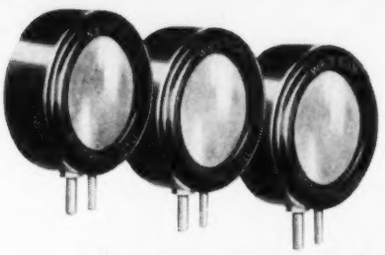


Panel Meters for Electronic applications



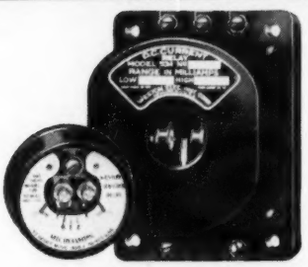
Electronic Circuit Testers

Ultra-Sensitive Laboratory Portables



*Photronic (photo-electric) Cells

Electronic Tube Checkers



Sensitive Relays

In the field of electronics, too, the measurement tools bear the name most familiar to you. For just as WESTON pioneered fundamental electrical measurement, as well as the special measurement needs of radio, so WESTON has provided simple, precise instruments and devices for the problems encountered in electronics research, production and control. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

*PHOTRONIC — *A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

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Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

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Contents

Minimum of Graphic Equipment Yields Maximum of Data 44
GUY H. KELSAY, Indianapolis Power & Light Company

Blackout Problems of a Utility Serving 16 Counties 47
W. R. HAMILTON, West Penn Power Company

Conservation of Materials in Substation Design 49
E. M. ADKINS, Jersey Central Power & Light Company

Streamlining Power Plant Maintenance Schedules 52

Adding Conductors Raises Line Capacity 57
CLAYTON M. ALLEN, Los Angeles Bureau of Power and Light

Priorities Problems 58

Editorials ..... 43 and 60

Washington Comment 62

News of the Week 63

How 74

Load Servicing 98

New Equipment 108

News About People 113

Manufacturing and Markets 122

Sales Opportunities 127

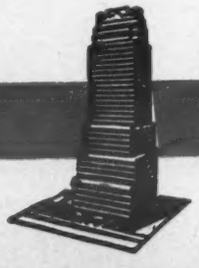
Recent Legislation 129

Recent Rate Rulings 130

Rural Allotments 131

Letters to the Editor 133

Index of Advertisements 136



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To .....

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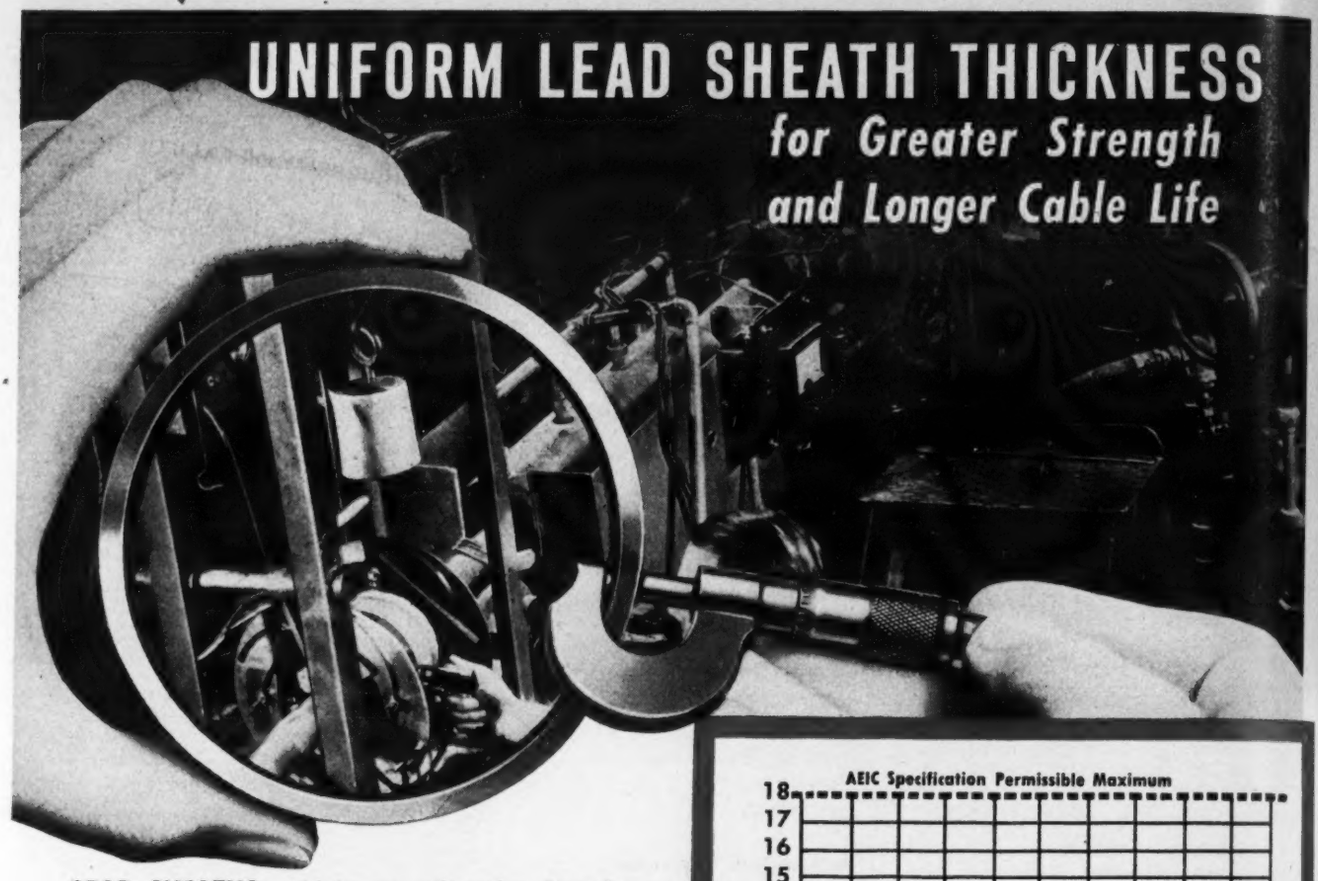
Through OKONITE-CALLENDER RESEARCH...

UNIFORM LEAD SHEATH THICKNESS

for Greater Strength and Longer Cable Life

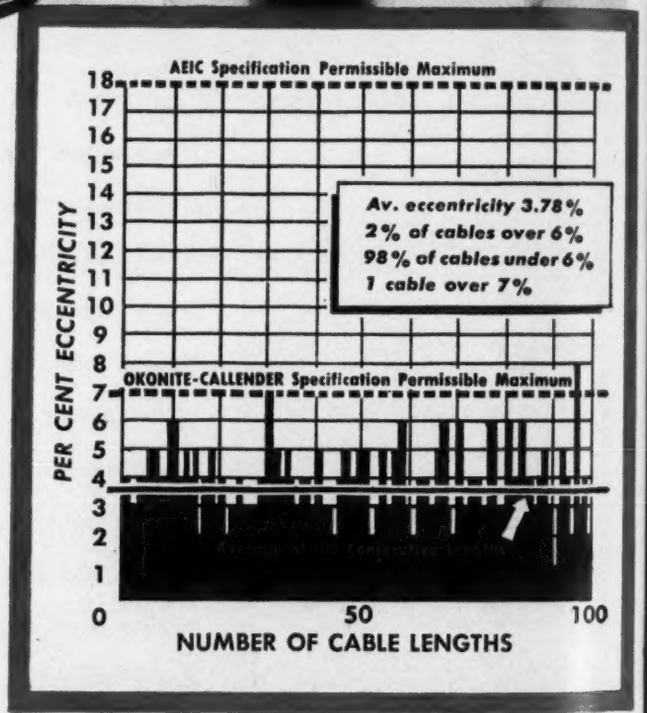


LEAD SHEATHS, which are otherwise free from structural defects, will fail ultimately at the thinnest point and cause cable failures.

The Okonite-Callender electric concentricity gauge measures the slightest deviation in sheath thickness throughout the length—at top, bottom and either side—thus permitting immediate adjustment of the lead press to keep the sheath uniform.

The accompanying chart shows the results of actual micrometer measurements made on 100 consecutive lengths of Okonite-Callender Paper-Insulated Lead-Covered Cables. This lead sheath uniformity was made possible by use of the Okonite-Callender electric concentricity gauge for lead press control.

When you are considering paper-insulated cable, it will pay you to have our engineers explain the many other Okonite-Callender research developments that contribute to longer cable life.

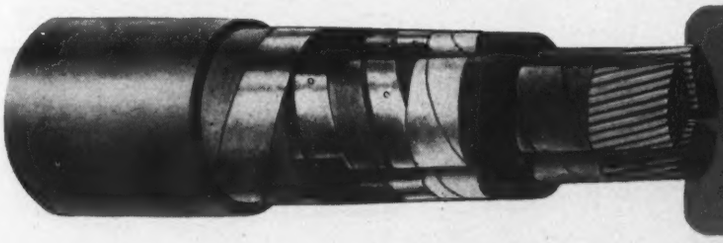


● Individual lead sheath eccentricity record. Results of actual micrometer measurements made on 100 consecutive lengths of Okonite-Callender Paper-Insulated Lead-Covered Cable, manufactured in regular factory production during January, 1943, and tested for sheath eccentricity in accordance with procedure required by A.E.I.C. specifications.

THE OKONITE-CALLENDER CABLE CO., Inc.

AN AFFILIATE OF THE OKONITE COMPANY

Executive Offices, Passaic, N. J. *Offices in principal cities*



OKONITE-CALLENDER

PAPER INSULATED POWER CABLES

3259

Salvage Your Scrap — Buy U. S. War Bonds

Electroline FIEGE HEAVY-DUTY DEAD-END

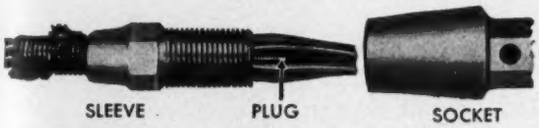
FOR COPPER STRAND (300 to 1000 MCM)

SIMPLE TO INSTALL

ONLY THREE SIMPLE OPERATIONS TO COMPLETE THE DEAD-END CONNECTION

Strand passed through sleeve.

Wires broomed out for insertion of hollow plug.



Plug driven in and wires closed to apply socket.

Socket applied showing twisted wires and completed assembly

Gives You These SIX ADVANTAGES

1 **HIGH PRESSURE**—Metal to metal contact under high pressure gives ultimate electrical and mechanical strength.

2 **STRONGEST TYPE OF DEAD-END** when used with steel, copper, or composite strands.

3 **SOLDERLESS**—No hot metal is needed. No special tools required. Common tools make or unmake the connection.

4 **EASY INSPECTION**—Inspection holes make visual inspection of the joint quick and positive. No guess work. A sound connection is certain.

5 **NO WASTE** of conductor. The connector can be used over and over again. Easily disconnected. Free from corrosion.

6 **CONDUCTIVITY**—Its resistance is less than an equivalent length of the conductor.

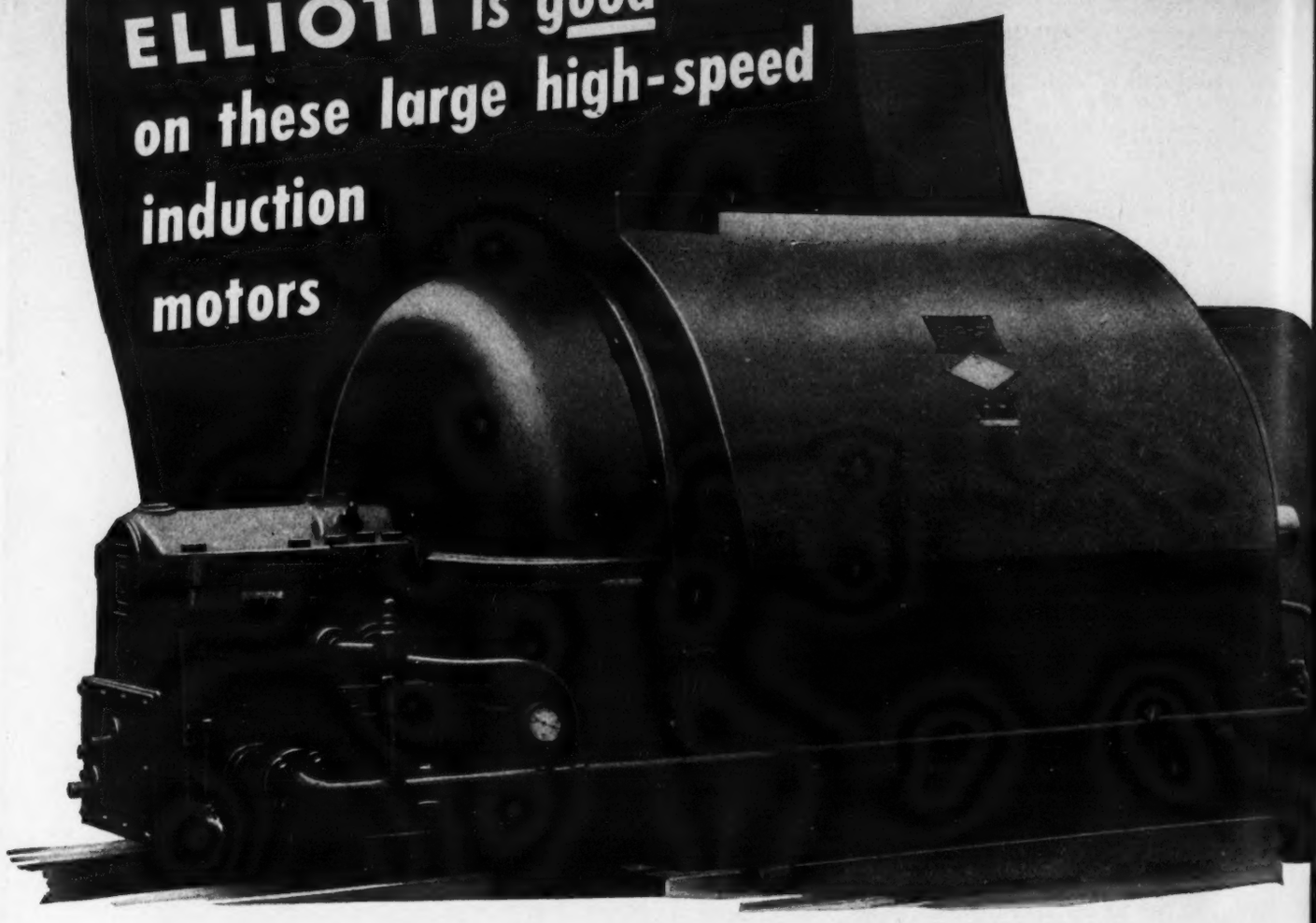
Available in complete range of sizes from 300 MCM to 1000 MCM in Dead-End types as illustrated. Also made in Eye and Straight Coupling types. ***Write today for complete prices and illustrated literature.***

Electroline Company

Originators and Patentees of Automatic Line Splices and Dead Ends

4121 SOUTH LA SALLE STREET • CHICAGO, ILLINOIS

ELLIOTT is good on these large high-speed induction motors



A RECENT CENTRAL STATION ADDITION GETS THIS ON

It's now driving a high-speed boiler-feed pump in the exte sion of one of the larger utility plants. A typical Elliott two-po squirrel-cage induction motor, 1750 hp., which incorporate all that Elliott has learned in experience and craftsmanshi during a quarter-century of concentration on the building o this type of motor. This particular unit has the Elliott patente "diamond cage" construction which gives high starting torqu — one of the design elements that enable these motors t develop new standards in performance.

Elliott motors of this type have pressure lubrication from a built-in unit. Stator frames are cast or welded steel, as desired. Large ventilating channels and ducts in shell and stator core insure cool, quiet operation. Structural design provides unusually high strength and rigidity at high speeds. Descriptive bulletin on request.

ELLIOTT COMPANY

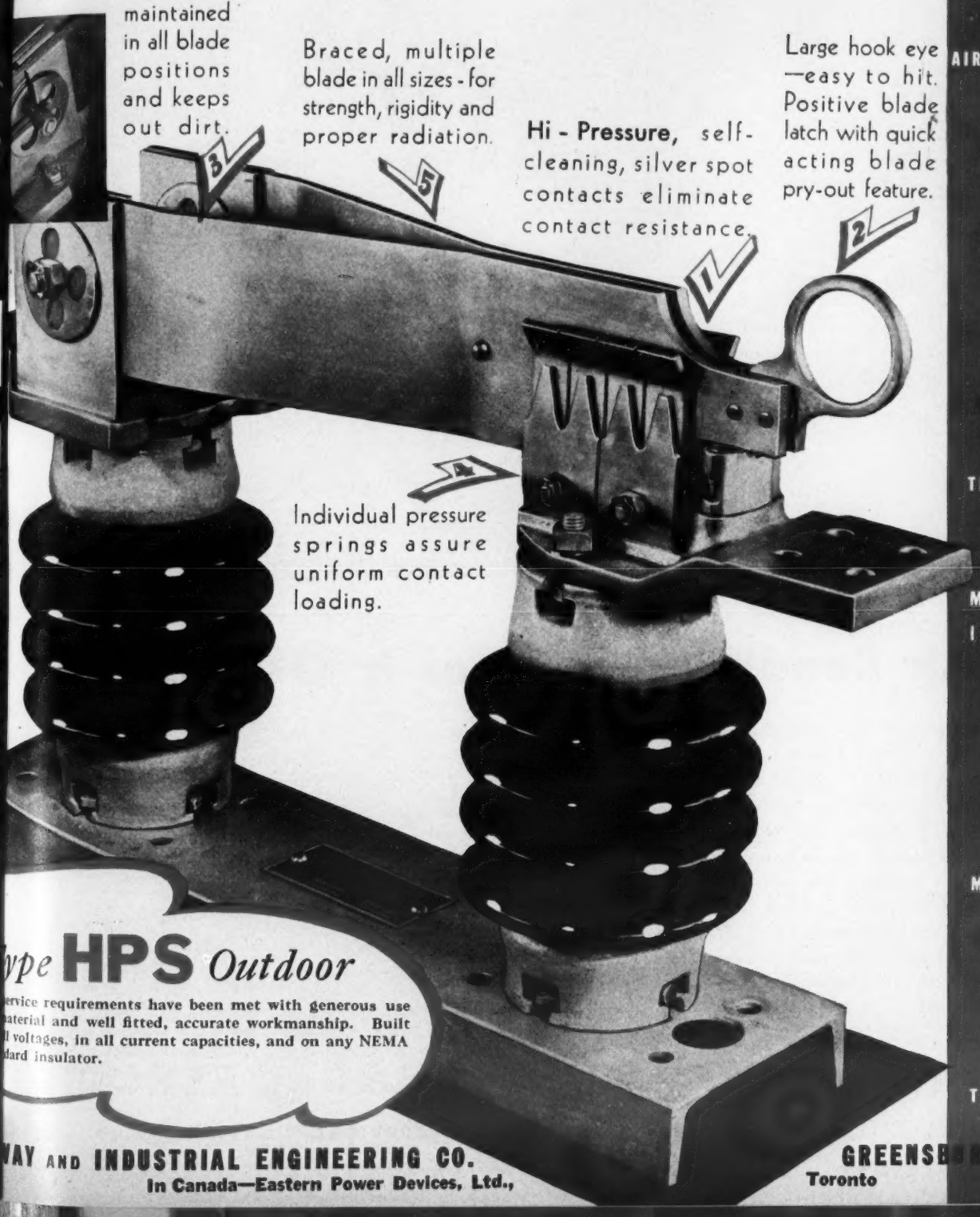
Electric Power Dept.

RIDGWAY, PA.

DISTRICT OFFICES IN PRINCIPAL CITIES

ELLIOTT MOTORS express the latest thought in motor desig

CHECK THE FACTS on R&IE Products



Hi-Pressure, annular, silver line contact hinge. Constant contact maintained in all blade positions and keeps out dirt.

Braced, multiple blade in all sizes - for strength, rigidity and proper radiation.

Hi - Pressure, self-cleaning, silver spot contacts eliminate contact resistance.

Large hook eye —easy to hit. Positive blade latch with quick acting blade pry-out feature.

Individual pressure springs assure uniform contact loading.

...ype HPS *Outdoor*

...ervice requirements have been met with generous use ...aterial and well fitted, accurate workmanship. Built ...l voltages, in all current capacities, and on any NEMA ...dard insulator.

...WAY AND INDUSTRIAL ENGINEERING CO. GREENSB...RG, PA.
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ENGINEERING AN...
PRODUCTION

COMPLETE SUBSTATION

OPERATING MECHANISMS

DISCONNECTING SWITCHES

AIR BREAK SWITCH

CONNECTORS

BUS CLAMPS

CUTOUTS

THERMO-RUPTER

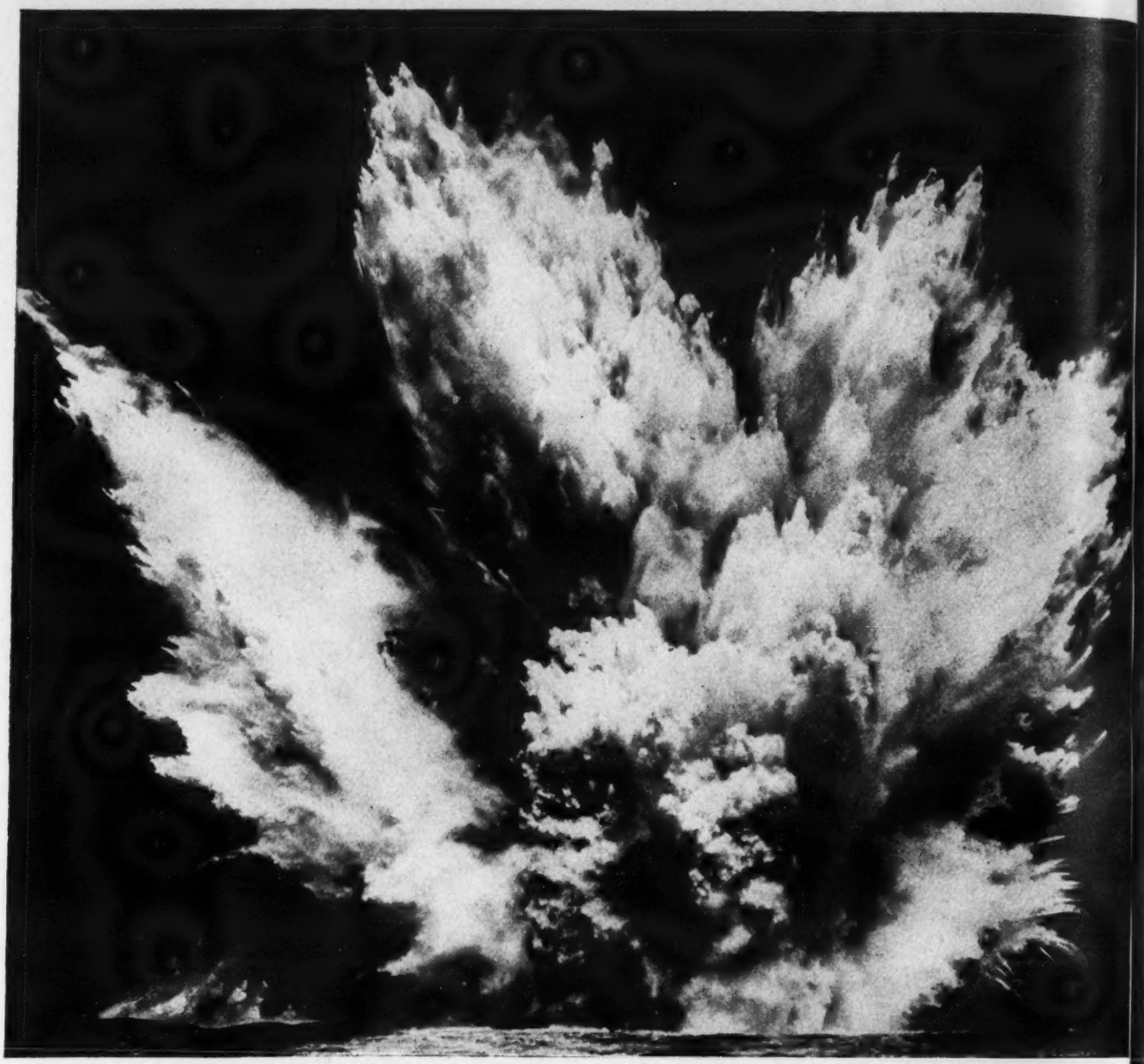
METAL HOUSE... ISOLATED BU...

AUTOMATIC THROW-OVER EQUIPMENT

METAL CUBICLE...

INTERLOCKS

TESTING DEVICE



Air Conditioning gives it OOMPH!

This war is being fought with *explosions.* All kinds... from block-busters to hand grenades. And don't forget the explosions in the barrels of guns that propel bullets and shells toward the enemy.

It takes a lot of skill to make a good explosion. Air conditioning helps.

The rate at which powder *dries* determines the way it explodes. It must not explode too soon or too late. Hence, special air conditioning . . . with temperature and humidity controlled precisely . . . is used for the drying of powder.

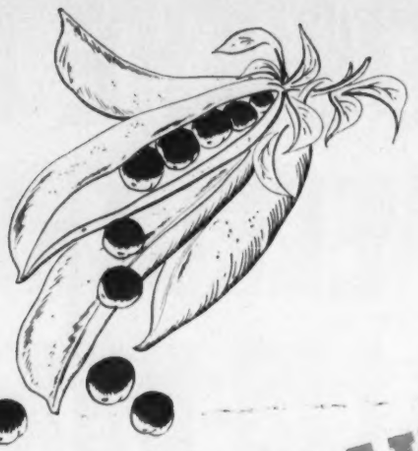
Also, air conditioning protects the lives of workers in munitions plants by providing the safest temperature and humidity conditions.

General Electric is an outstanding supplier of the new improved kind of air conditioning equipment needed for these wartime requirements. It has developed equipment more flexible, more compact than ever before . . . with more accurate temperature and humidity control.

Today this equipment is being devoted to winning the war. After the war, a far better air conditioning will be made available for offices and factories, stores and theatres; homes, hospitals and hotels . . . from General Electric.

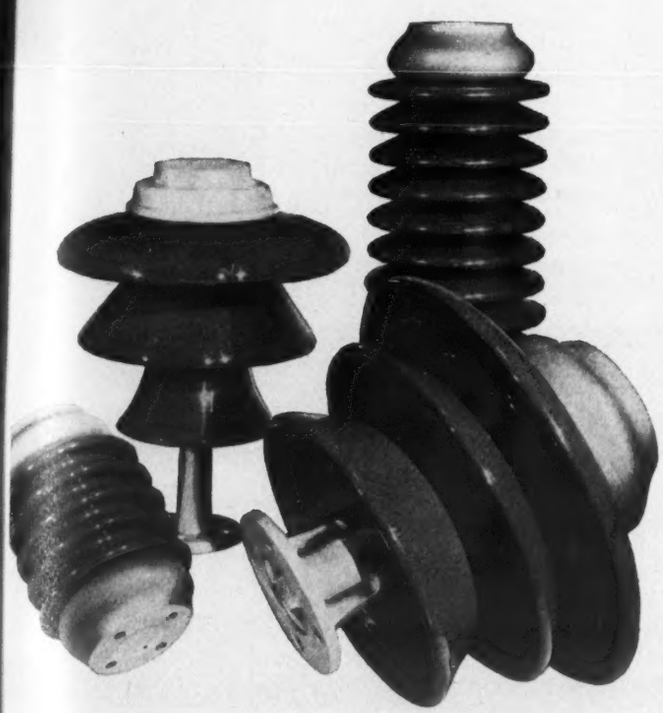
Air Conditioning and Commercial Refrigeration Department, Division 433, General Electric Co., Bloomfield, N. J.

Air Conditioning by **GENERAL ELECTRIC**



ALL PEAS . . . DON'T *TASTE* ALIKE!

When we want to express similarity of things we sometimes say, "alike as two peas", which is a swell comparison if we disregard what peas are for. When we eat them, they don't all *taste* alike...That's the way it is with station insulators. All are accurately made to published standards--alike as two peas?...But you can't specify things that make a product really superior. Skill, knowledge, facilities, and an honest desire to do a good job can't be standardized...O-B station insulators meet every requirement of insulation standards, but they'e also made to do an exacting job, do it well, and keep on doing it indefinitely. Standards protect the buyer on those things to which they apply; but when your station insulators bear the O-B trade mark, you get more than standards--you are protected all the way!



2428-H

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario

★

KEEP BUYING WAR BONDS

HERE'S THE COMING THING
NEW ELECTRO-COOLER THAT
ALLIS-CHALMERS POWER

★ New Allis-Chalmers ELECTRO-COOLERS can step up capacity of most transformers now in service by as much as 60%! Installation is simple, quick, inexpensive!

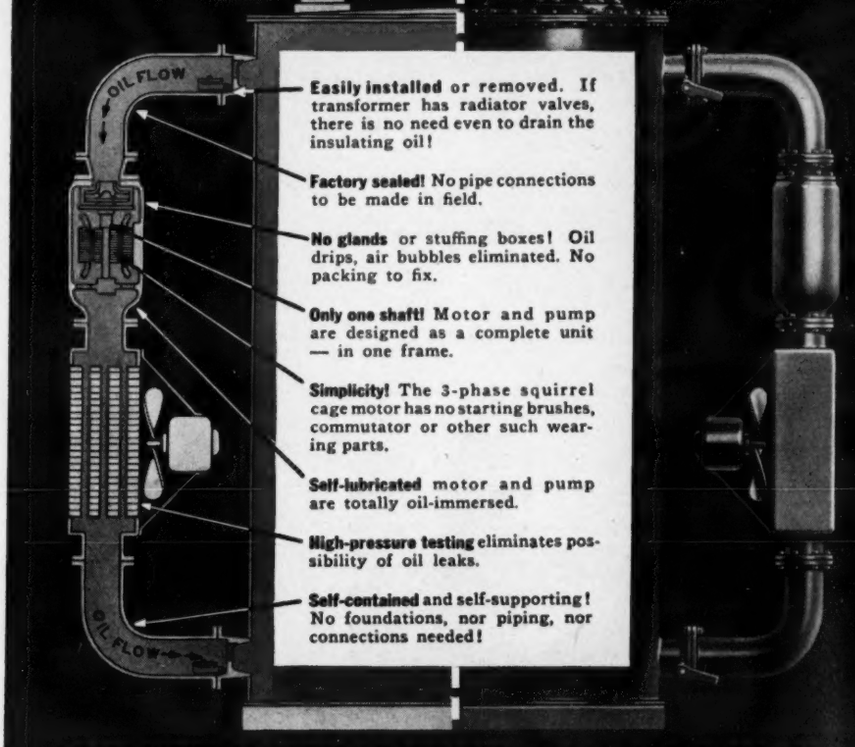
★ The new ELECTRO-COOLER is self-contained and self-supporting ... employs no stuffing boxes ... is self-lubricating. Here's forced-oil cooling at its finest ... a sound long-term investment.

★ New transformers built with ELECTRO-COOLERS use 25% less copper and steel than formerly ... cost correspondingly less!

★ When ELECTRO-COOLERS are put on existing transformers, up to four times their own weight in scrapped radiator steel is saved for other essential war uses.

★ This entirely new unit is not to be confused with adaptations of air conditioning devices.

Highlights of New Electro-Cooler


OIL FLOW
OIL FLOW
Easily installed or removed. If transformer has radiator valves, there is no need even to drain the insulating oil!
Factory sealed! No pipe connections to be made in field.
No glands or stuffing boxes! Oil drips, air bubbles eliminated. No packing to fix.
Only one shaft! Motor and pump are designed as a complete unit — in one frame.
Simplicity! The 3-phase squirrel cage motor has no starting brushes, commutator or other such wearing parts.
Self-lubricated motor and pump are totally oil-immersed.
High-pressure testing eliminates possibility of oil leaks.
Self-contained and self-supporting! No foundations, nor piping, nor connections needed!

THIS NEW SYSTEM IS SPECIFICALLY DESIGNED FOR FORCED-OIL COOLING OF POWER TRANSFORMERS!

ALLIS-CHALMERS

IN FORCED OIL COOLING— JUMPS CAPACITIES OF MOST TRANSFORMERS 20-60%!

Now you can handle increased load without adding any new power transformers!

TODAY almost all U. S. power transformers depend for cooling on slow thermo-syphon flow of insulating oil through their radiators.

By accelerating that flow with pump action — and by forcing cooling air over radiator surfaces — the capacity of those transformers can be sharply increased.

That's exactly the job Allis-Chalmers' new ELECTRO-COOLER was designed to do!

On most transformers, the new ELECTRO-COOLER can step up capacity 20 to 60%. Welcome news in wartime!

Simple to Install

New foundations are not required . . . there's no need to shift transformers. ELECTRO-COOLERS are self-supporting.

Because the ELECTRO-COOLER is factory-assembled as a unit, there are no pipe connections or joints to be made in the field.

Maintenance? It's at a *minimum!* To reduce possibility of oil leaks or seepage, every ELECTRO-COOLER is factory-tested at 50 pounds pressure. (Maximum *working* pressure is only a few pounds!)

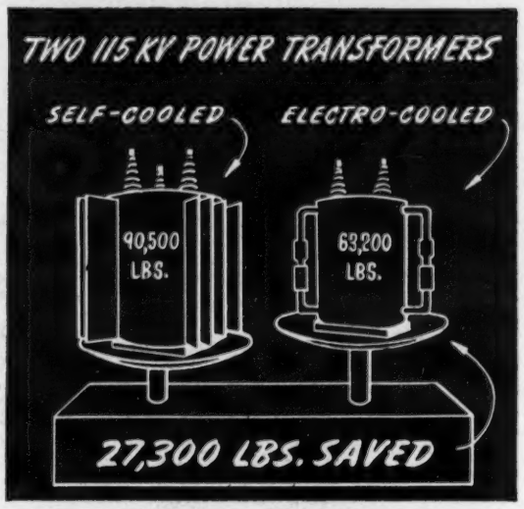
And there are no stuffing boxes to require packing. Motor and pump are built on one shaft and in one frame for greater strength. They're *self*-lubricated!

Big Metal Savings

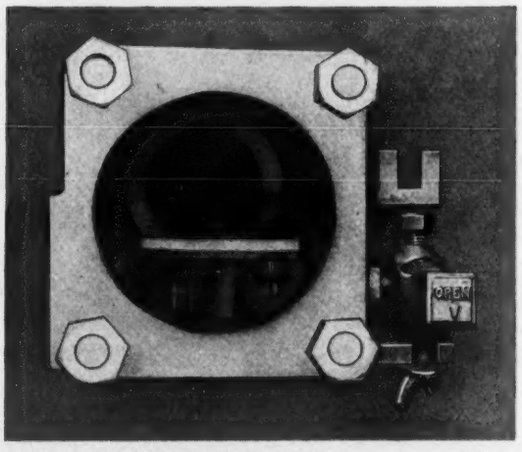
Applied to new transformers, the new ELECTRO-COOLER reduces copper and steel needed by about 25%. Added to existing transformers, it saves up to four times its own weight in scrapped radiator steel for other vital uses!

Here's a wartime investment with a great peacetime future! To learn what the new ELECTRO-COOLER can do for *your* system, call the district office near you. And write for Bulletin B6242. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1566



Savings like these in copper and steel — an average of 25% — can be made on every contemplated power transformer installation.



No need to drain oil if transformer has this standard radiator valve.

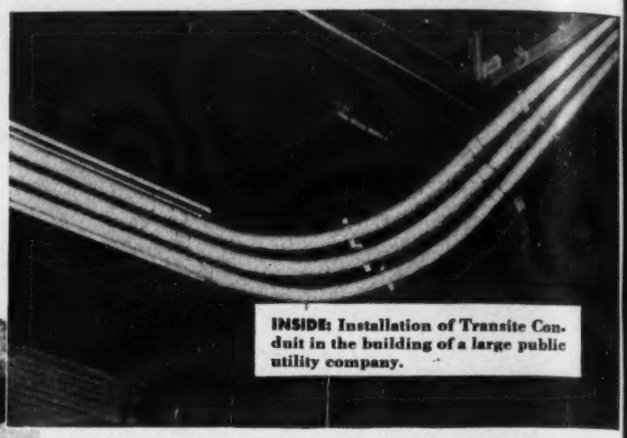
TRANSFORMERS

A-C ALLIS-CHALMERS MILWAUKEE — WE WORK FOR VICTORY — WE PLAN FOR PEACE

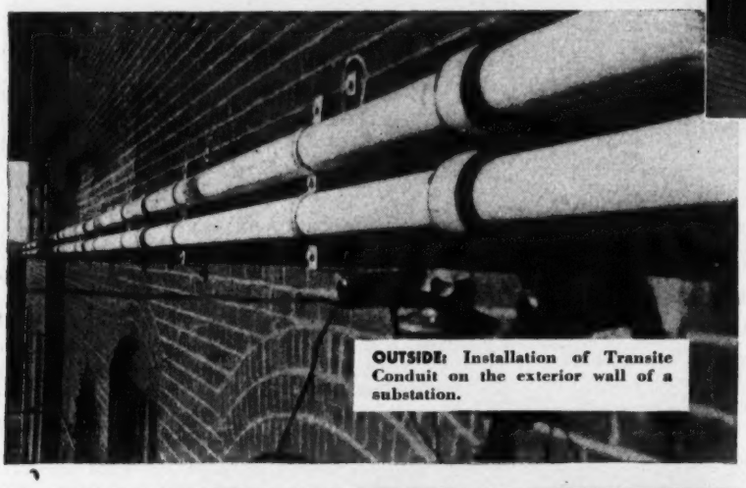
WPB Order L-225 does not apply to this modern type of Conduit...

when used Inside, Outside or Underground

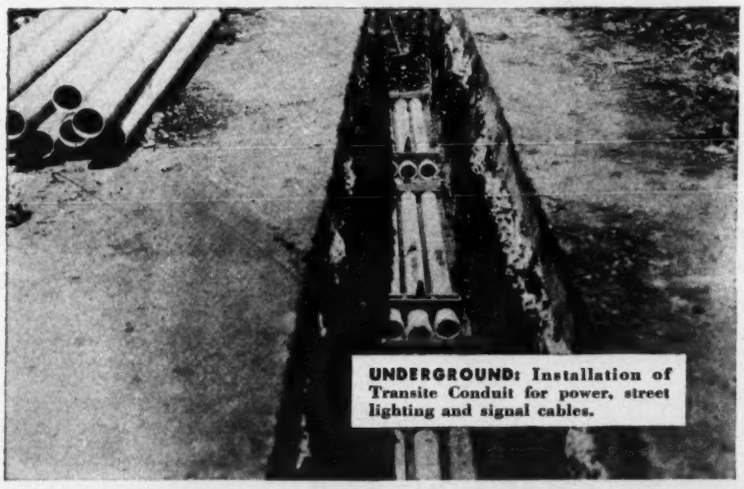
J-M TRANSITE CONDUIT is a non-metallic duct offering strength, incombustibility, permanently smooth bore, elimination of electrolysis problem and ease of installation . . .



INSIDE: Installation of Transite Conduit in the building of a large public utility company.



OUTSIDE: Installation of Transite Conduit on the exterior wall of a substation.



UNDERGROUND: Installation of Transite Conduit for power, street lighting and signal cables.

CURRENT RESTRICTIONS imposed by General Limitation Order L-225 on the manufacture, delivery and installation of electrical conduit, tubing and raceways—do *not* apply to Johns-Manville Transite Conduit when used inside, outside or underground.

This modern type of Conduit offers many advantages for use in fire and traffic signal systems, private right-of-way installations, and underground service connections to residential and commercial buildings.

Transite Conduit is so strong that it needs no protective casing underground; withstands earth loads and traffic pressure. When "concreting in," use Transite Korduct—thinner-walled, lower-priced, otherwise identical with Conduit.

For complete details on J-M Transite Ducts, write for Data Book DS-410, Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville

TRANSITE DUCTS

TRANSITE KORDUCT— for installation in concrete

TRANSITE CONDUIT— for exposed work and installation underground without a concrete encasement

It's there in an Emergency

The **KEARNEY FUSE LINK DISPENSER**

Equipped with a

PUL-TAB FUSE-PAK of KEARNEY FUSE LINKS

Note above, the Pul-Tab Fuse Pak with clearly identified links. And note, too, the handy five-Pak, twenty-five link carton.

Operating men, particularly those responsible for the flow of power into our vital war industries—Army, Navy, Air Corps, and Navy projects—have been quick to see the advantages of having—the right fuse link, at the right place, at the right time.

And when you install Kearney No. 12165 Fuse Link Dispensers equipped with Pul-Tab Fuse-Paks on the poles at important locations—you're ready for emergencies with extra and proper fuse links which come in the handy Kearney Pul-Tab Fuse-Pak. You'll find these dispensing boxes handy, too, mounted in trouble trucks—with various rated links, ready for emergencies.

Precision-Built FUSE LINKS

Recognizing the urgent necessity of providing fuse links which will avoid unnecessary outages on lines protected with modern Fuse Switches and Cutouts, the Kearney Corporation offers a line of improved fuse links that have accurate, low temperature, pure tin fuseable elements, which carry normal loads safely and likewise isolate faults promptly. Thus, operating men throughout the country are using these dual-purpose links in Kearney Trip Out, Trip-O-Matic and Trip-Saver Switches and in other conventional cutouts, too.

Really, since they cost no more, take advantage of the protection which these Kearney precision-built fuse links provide . . . And remember, they come packed in handy Pul-Tab Fuse Paks, 5 links to a Pak. Each link is in an individual bag with amperage rating clearly printed on the "pul-tab." Standard square cartons contain 5 Fuse-Paks, a total of 25 fuse links. Order No. 12165 boxes and Fuse Paks now for emergency advantages.

JAMES R. KEARNEY CORPORATION JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. **4236 CLAYTON AVE., ST. LOUIS, MO.**

The Mark of Quality Products

GOULD PLANTÉ QUALITY IS PRE-WAR

RATED CONSERVATIVELY—Goulds will equal or exceed in capacity any battery of comparable size and cell structure. Buy on proven performance and you will buy a Gould!

THE Gould Plante you buy today will deliver the same performance and long life that have made this battery outstanding for 43 years. It is still your best choice for emergency lighting and control operation.

But don't buy a new one unless you have to! Get the most out of your present Gould Plante. The Gould method of forming spun plates of pure lead enables the full capacity of the plates to be used, which means that Gould Plante will deliver, not years, but decades of service.

FREE HELP ON BATTERY PROBLEMS—Your Gould Service Men will help you get full service from your present equipment, regardless of make. No charge, no obligation. Write Gould Storage Battery Corp., Depew, N. Y. Ask for FREE descriptive literature on any type of industrial installation.

GOULD THE BATTERY PICKED BY ENGINEERS

HOW TO SOLVE
Operating Problems with Correct Lubrication
HIGHLY POLISHED SURFACES LIABLE TO CORROSION...WEAR
MUST SEAL OUT DUST ...PREVENT LEAKAGE

Prevent Corrosion & Pitting

AFTER YOU'VE DECIDED to use Gargoyle BRB Greases for ball bearings you can go back to getting out production and be assured *that* problem is solved.

These greases do not break down and form the deposits which lead to corrosion and pitting.

In fact, their reliable stability allows bearings to go through periods of a year or more without repacking.

In addition, these greases do not change in structure within wide temperature ranges.

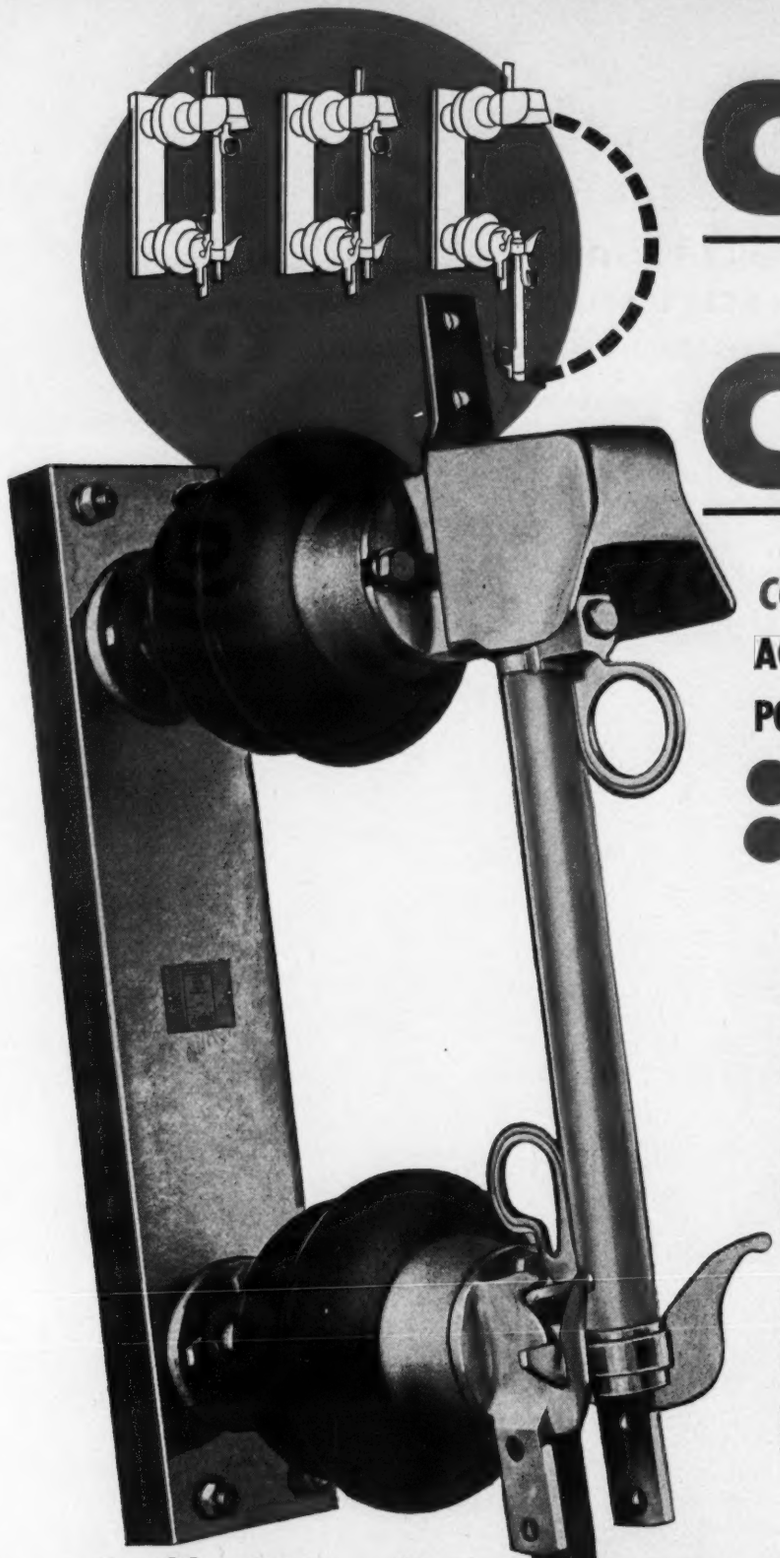
Here are greases you can *depend* on! This has been proved in thousands of applications under operating conditions.

You've solved an important operating problem when you let the Socony-Vacuum man who calls on you specify Gargoyle BRB Greases for the ball bearings in your plant.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM



all clear

COMPLETE 180-DEGREE "DROP-OUT" ACTION OF NEW WESTINGHOUSE DBA POWER FUSES . . .

- **Assures Positive Isolation of Fault**
- **Signals Clearly Which Fuse Has Operated**

Arcs are effectively extinguished with the new Westinghouse DBA Boric Acid Fuse. Within ½ cycle, the arc is quenched by "De-ion" action. Full "Drop-Out" action then makes isolation positive. The top of the fuse tube is thrown completely clear to place maximum air space between live and faulted circuits. No burning or arcing can occur at contacts.

The "Drop-Out" action not only signals that the circuit is "All Clear", but also tells at a glance which fuse has blown. In many types of multi-circuit installations, this saves valuable time.

Ratings: DBA boric acid power fuses are available in a complete line from 7.5 to 69 kv, and from ½ to 200 amperes, with interrupting capacity from 8500 amperes at 7.5 kv to 4000 amperes at 69 kv.

For complete information, call your Westinghouse Office or write for B-3198, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

J-60521

Double Action gives *COMPLETE ISOLATION*

1. **"DE-ION" ACTION** instantly quenches arc inside boric acid tube. Fuse melts, allowing spring to withdraw rod and lengthen arc. Resulting water vapor "De-ionizes" and blows out arc.

2. **"DROP-OUT" ACTION** removes the fuse unit from circuit and isolates the faulted equipment.

WESTINGHOUSE

Westinghouse POWER FUSES

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Nearly 40 per cent of industry's younger workers have eye defects! The eyes of all employes suffer strain and fatigue under inadequate illumination. Read how MILLER LIGHTING can help you eliminate plant accidents, layoffs and lost time . . .

Under today's terrific pressure men with perfect vision work fast and accurately only with adequate illumination. But remember...a high percentage of industry's workers do *not* have perfect vision! They can do all expected of them...*all they want to do*...without accidents or slowdowns, only if you help them see clearly and sharply at all times.

MILLER 50 FOOT CANDLER or 100 FOOT CANDLER, the *original* continuous wireway fluorescent lighting systems, can provide war-manpower with adequate man-made *daylight* for better, faster, safer production. Or, MILLER can provide modern incandescent or mercury lighting, depending on the individual plant's set-up and particular problems.

Because of this the MILLER field engineer is in an unbiased position to work with you right now . . . to cooperate intelligently in the fine work you are now doing to help American industry speed Victory.

THE MILLER COMPANY · MERIDEN, CONNECTICUT

ILLUMINATING DIVISION • **OIL GOODS DIVISION** • **ROLLING MILL DIVISION**
Fluorescent, Incandescent, Mercury Lighting Equipment
Domestic Oil Burners and Liquid Fuel Devices
Brass and Phosphor Bronze in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
Since 1844

FOR LOW-COST, HIGH-EFFICIENCY INSULATING OIL MAINTENANCE

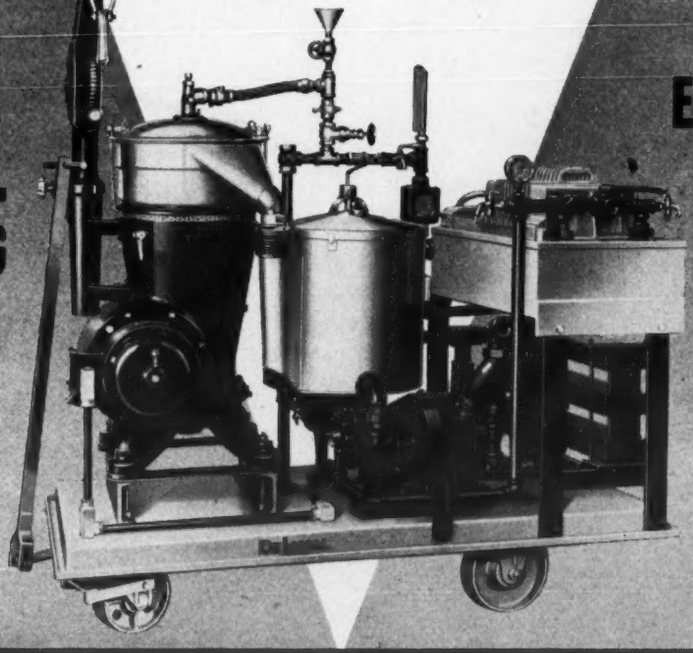
SPEED and economy of operation combine with dependability of results to make the De Laval Insulating Oil Purifier the choice of leading power systems in meeting their oil maintenance problems.

The De Laval Purifier restores the required high dielectric value of oil in a single pass, eliminating re-runs; continuously discharges water, permitting long, continuous operation at uniformly high efficiency with a minimum of attention. As a result, the yearly cost of dehydrating oil in transformers and circuit breakers can be much reduced.

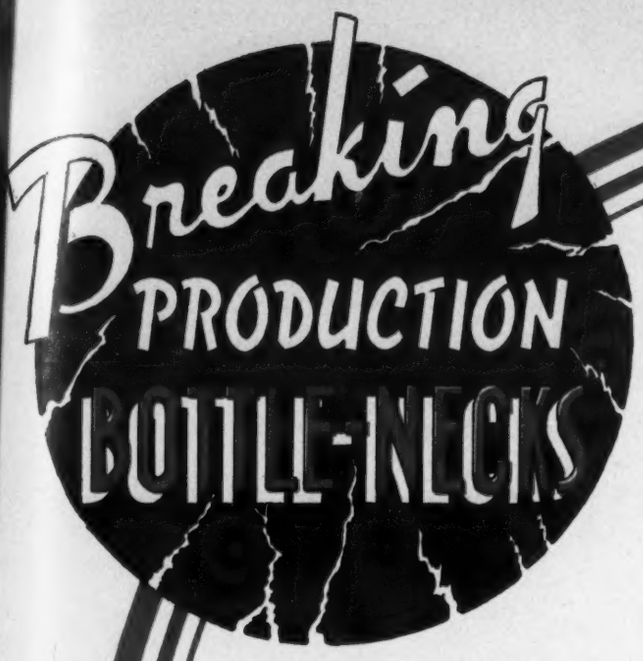
Speedier, less costly oil purification, which is at the same time more positive, leads naturally to improving the average dielectric value of oil in all units, thus contributing directly to dependable sub-station performance.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York
427 Randolph St., Chicago
DE LAVAL PACIFIC COMPANY
61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal, Peterborough
Winnipeg, Vancouver

THE DE LAVAL INSULATING OIL PURIFIER



ECONOMICALLY PROTECTS OIL-INSULATED EQUIPMENT



SIMPLEX...

Insulated Wires and Cables must conform to war-time regulations now and "for the duration" but they retain the properties necessary for satisfactory service.

Into them we are putting the accumulated "know-how" of nearly sixty years devoted exclusively to making wires and cables with rubber, varnished cambric, impregnated paper and plastic insulations.

Shortages of many of the materials normally used in insulated wires and cables have seriously upset production schedules but expert use of what is available is breaking production bottlenecks caused by restrictions designed to conserve and control "critical materials."

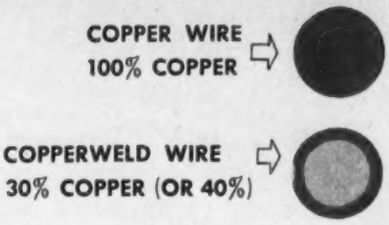
The background of knowledge and skill built up during more than a half century now enables us to make the most of the limited materials we can get.

If you are doing essential, high priority war work and must have new cables we shall be glad to tell you more about Simplex cables and what they can do for you.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY E NAVY

Simplex WIRES and CABLES



You *can* obtain Copperweld . . . on WPB-approved Orders

Every once in awhile one of our customer friends tells us he is under the impression that we are unable to produce Copperweld for him because we're "loaded to the gills" with war orders. It is true that a large part of our capacity is now devoted to direct war production, *but we still have capacity to produce more Copperweld products which can contribute to the winning of the war.* If WPB approves your order, you *can* obtain Copperweld. And you *can* have it on hand when you need it if you ANTICIPATE your requirements, ORDER EARLY and in accordance with WPB requirements.

COPPERWELD STEEL COMPANY · *GLASSPORT, PA.*

Anticipate your needs Order Early - - Order in accordance with WPB requirements

COPPERWELD

SAVE HUNDREDS OF TONS OF COPPER WITH COPPERWELD

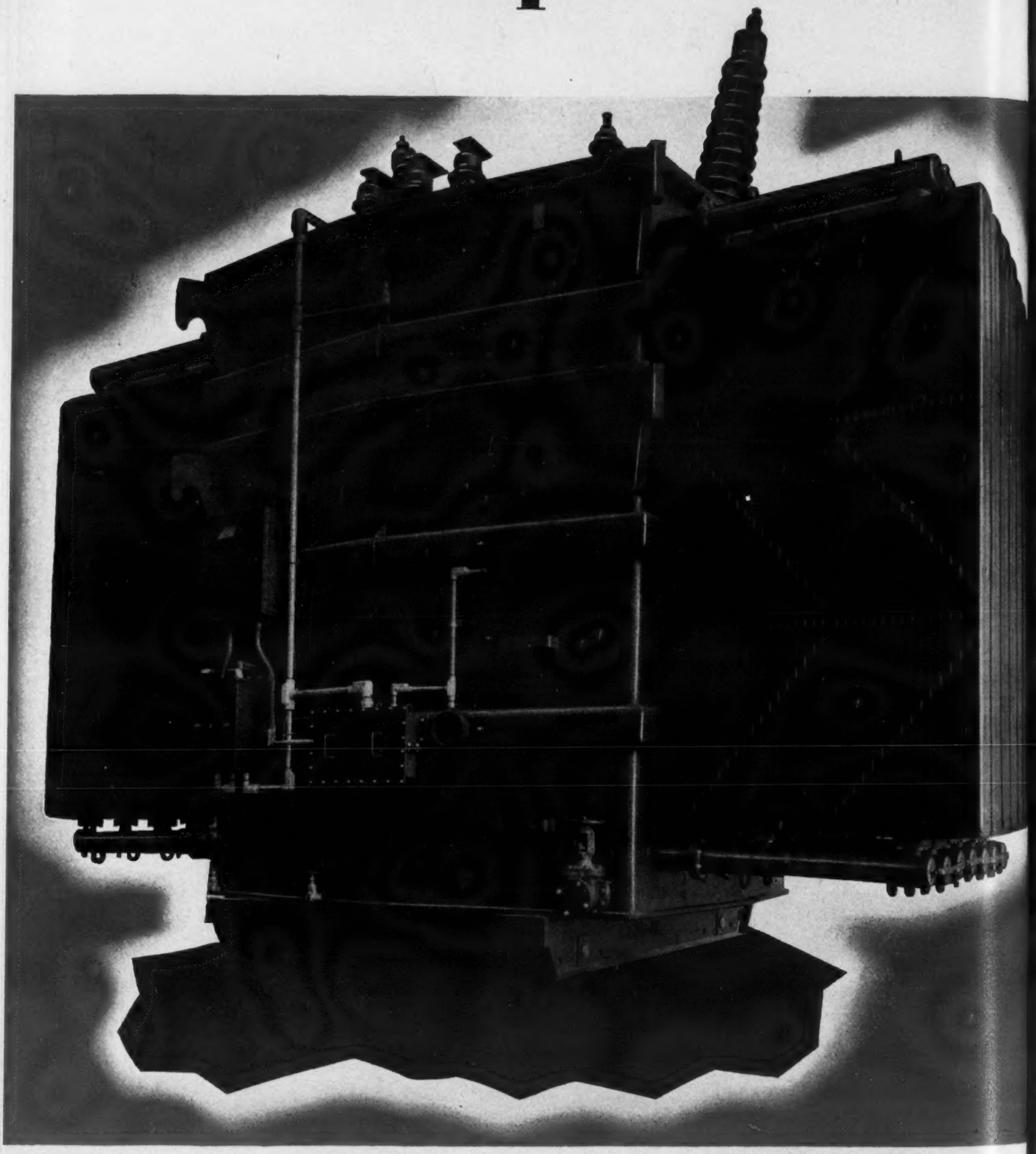
POTTERS' WHEEL: 1943. In the Lapp factory, a centuries-old technique in clay handling becomes a fundamental process in production of the world's most up-to-the-minute insulator. It may fairly be said that the Line Post owes its existence to the fact that Lapp clay can be handled by this throwing process. Here air-free clay is worked and reworked, refined and formed, preparatory to the Lapp dry-turning process. To know more about porcelain—and so to produce better porcelain—is the basis on which Lapp claims to produce insulators which will perform better on your lines. May we describe to you the many reasons behind this claim? Lapp Insulator Co., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

Hipersil*



New Hipersil, 36,000 kv-a Power Transformer
OISC; three-phase; 161 kv to 13.2 kv.

WESTINGHOUSE

HEAVY-DUTY POWER TRANSFORMERS ON A WAR-ECONOMY BASIS

HIPERSIL SAVES

- 25% OF CORE STEEL
- 10% OF COPPER AND INSULATION
- 5% OF STRUCTURAL STEEL
- 10% OF OIL

Hipersil core steel effects savings greater than ever achieved before by any material, or by any other manufacturer.

For example, Hipersil reduces the weight of a 36,000 kv-a power transformer from 303,000 to 266,800 pounds . . . saving more than 23,000 pounds of electrical steel, 2,300 pounds of tank steel, 2,800 pounds of copper and 8,100 pounds of oil.

The materials saved are enough to build another power transformer rated at 6,000 kv-a, OISC, or 8,000 kv-a, OISC/AB; single-phase; 46 kv to 13.2 kv.

These SMALLER AND LIGHTER Power Transformers conserve transportation facilities; reduce man-hours needed for assembly and installation; and may result in material savings in the overhead steel structures required in substations.

AND . . . every time you buy a Westinghouse Hipersil Transformer, you help America conserve critical materials. For complete information, call your Westinghouse office. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania. J-70373

*Registered trade-mark. Westinghouse Electric & Manufacturing Co., 1934

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

POWER TRANSFORMERS

2000 to 5000 Amperes

Easy Operation! No Overheating!

DELTA-STAR switches can be counted upon to meet war production demands of more power and better service. Rugged in construction, they're built to carry rated load continuously without overheating yet overcome operating difficulties, the usual bugaboo of high capacity switches. DELTA-STAR switches are easy to operate.

Consider these advantages:

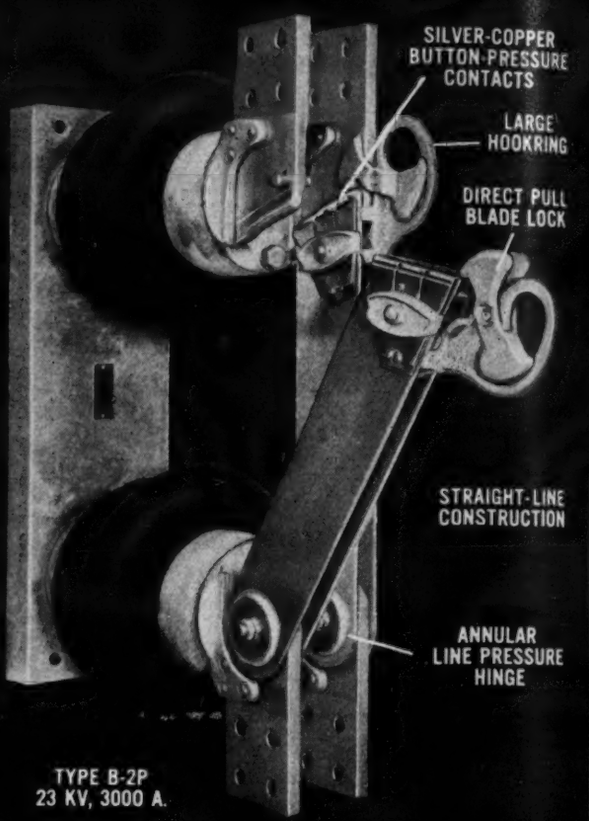
STRAIGHT LINE CURRENT PATH
PRESSURE-BUTTON CONTACTS
ANNULAR LINE-PRESSURE HINGE
TONGUE TYPE CONSTRUCTION
SILVER-TO-COPPER CONTACTS
BALL TYPE PRESSURE RELEASE
MINIMUM CRITICAL MATERIAL
NO CURRENT CARRYING CAST PARTS

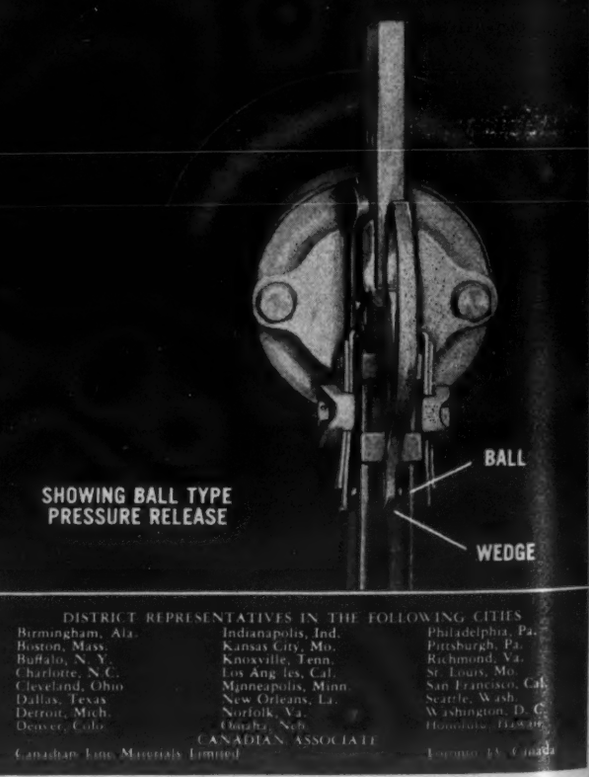
These switches incorporate all the best known features for long, hard service. When they must be operated, the contact pressure is released by a gentle pull on the hookring. Continued pull opens the blade with surprisingly small effort for such heavy construction.

Furnished as shown for connecting to vertical bars or can be provided with tangs for special arrangements of vertical or horizontal bars. Clamp type terminal lugs can be provided for tubing or cable. Also supplied with corrugated insulators for indoor service.

Ask for Publication No. 4205

For listing and dimensions of switches rated 7.5 to 34.5 kv, 2,000 to 5,000 amperes.





DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago, Ill.
NEW YORK OFFICE — 140 Cedar St., New York, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

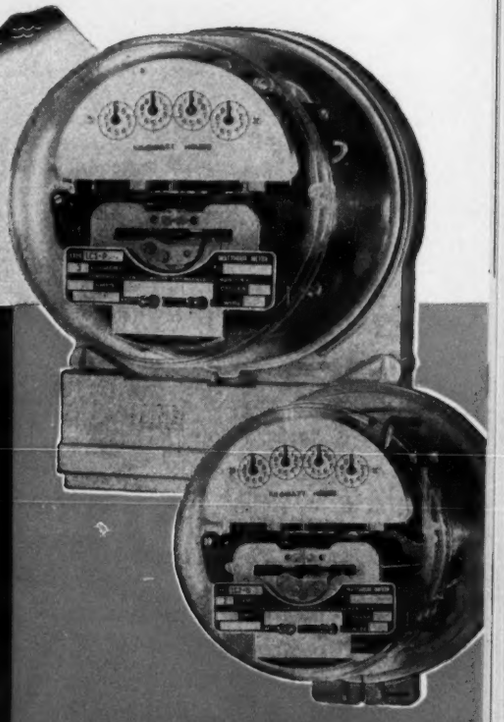
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Charlotte, N. C.
Cleveland, Ohio
Dallas, Texas
Detroit, Mich.
Denver, Colo.
Indianapolis, Ind.
Kansas City, Mo.
Knoxville, Tenn.
Los Angeles, Cal.
Minneapolis, Minn.
New Orleans, La.
Norfolk, Va.
Omaha, Neb.
Philadelphia, Pa.
Pittsburgh, Pa.
Richmond, Va.
St. Louis, Mo.
San Francisco, Cal.
Seattle, Wash.
Washington, D. C.
Honolulu, Hawaii

CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada

WAR BONDS MAKE UNCLE SAM MORE POWER-*full*

"On Measurement is founded the whole progress of man.."

The French Revolution did unto scientific researches as it did to many other things—blew them up and let them lie where they fell. One ten-millionth of the distance from the equator to the pole was designated as the "meter". To establish it, two French scientists measured the distance from Dunkirk, France, to Barcelona, Spain, in 1792. They found themselves dodging hostile efforts of all factions; in addition, the accuracy of their findings was doubtful. Yet, that was the conception of standardization. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watthour meters.



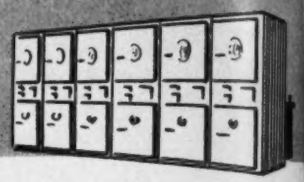
NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

EC&M Steel-Clad MOTOR CONTROL

for 2300 VOLT

SYNCHRONOUS MOTORS FOR SINGLE MOTOR APPLICATIONS OR FOR GROUP MOTOR INSTALLATIONS



WITH all wiring complete, this Control is quickly installed. It has the advantage of single unit use but can be readily assembled into a group of several units due to its unique design and construction.

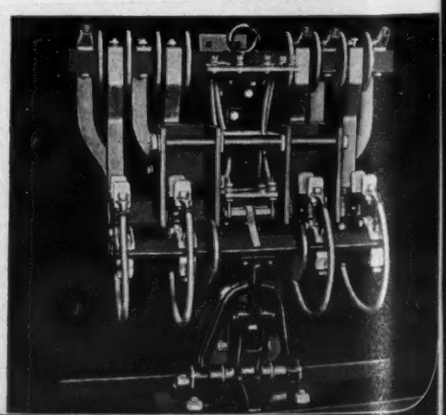
In addition, this unit has disconnect fuses giving short-circuit protection. These are selected to meet normal motor currents and also have sufficient rupturing capacity to meet the requirements of the power-circuit. Motor protection is supplied by EC&M Type ZM Overload Relays which have a reputation for accuracy and reliability.

For illustrations and applications of EC&M Steel-clad Motor Control to meet the requirements of squirrel-cage, synchronous and wound-rotor motors, both low and high voltage, send for Booklet No. 67.

OUTSTANDING FEATURES OF DESIGN

1. Safety interlocks on all starter units.
2. Self-contained bus between units when arranged for group installation.
3. Semi-dust-tite enclosure (NEMA Type 1A).
4. Utmost accessibility through front doors and rear plates.
5. Removable plate on end unit for bus extension when adding units for a group installation.

THE ELECTRIC CONTROLLER & MFG. CO. — E&M — CLEVELAND, OHIO



At right: EC&M Magnetic Contactor for 2300 Volt Motor Control Applications.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND ★ OHIO

FWD FIELD REPORTS
From the WORKING FRONT

Winding mountain roads—12% grades—loads of 50 to 75 tons—are tough operating conditions for any truck . . . FWD four-wheel-drive trucks meet every demand for dependable hauling power and set a record in low fuel costs as well.

This performance record is one of many examples of FWD Low Fuel Cost

COMMERCIAL

CONSTRUCTION

UTILITIES

FWD TRUCKS

OIL FIELDS

MILITARY

IN EVERY FIELD WHERE TRUCK QUALITY IS PUT TO THE TEST—FWD's STAND UP!

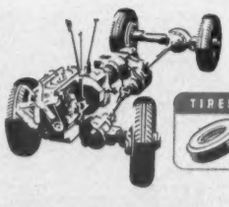
HAULING pine and fir logs, 32 ft. long, with average pay-loads of 50 tons and running as high as 75 tons, at an altitude of 4100 to 6000 ft., over 12% grades on the narrow and winding logging roads of the Feather River Canyon of California, is a tough trucking job any day of the year—and particularly in spring when trucks have to pull through hub-deep mud.

George Howell, of the Howell & Howell Logging Company, finds his fleet of three FWD's fully equal to the task and regularly makes the 11-mile haul four times daily with each truck. His daily cost for Diesel fuel is $3.12 per truck, and he states, "I have hauled more logs for less money with FWD's than I have with any other make of truck during my 21 years of truck logging experience."

George Howell's experience is typical of that of many truck operators who know the FWD's capacity to do more in less time at lowest cost. Equalized power and load distribution in an FWD make it surer and safer on all types of road—the full power and grip of four driving wheels provide extra grade climbing ability and capacity to get through where the going is tough—and, more important than ever today, the true application of the four-wheel-drive principle in an FWD holds all operating and maintenance costs—gas, oil, tires, to the very minimum.

Motor transport today must deliver the goods with more than usual speed, safety and dependability—and truck operators know that FWD trucks qualify on every count.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory: Kitchener, Ont.

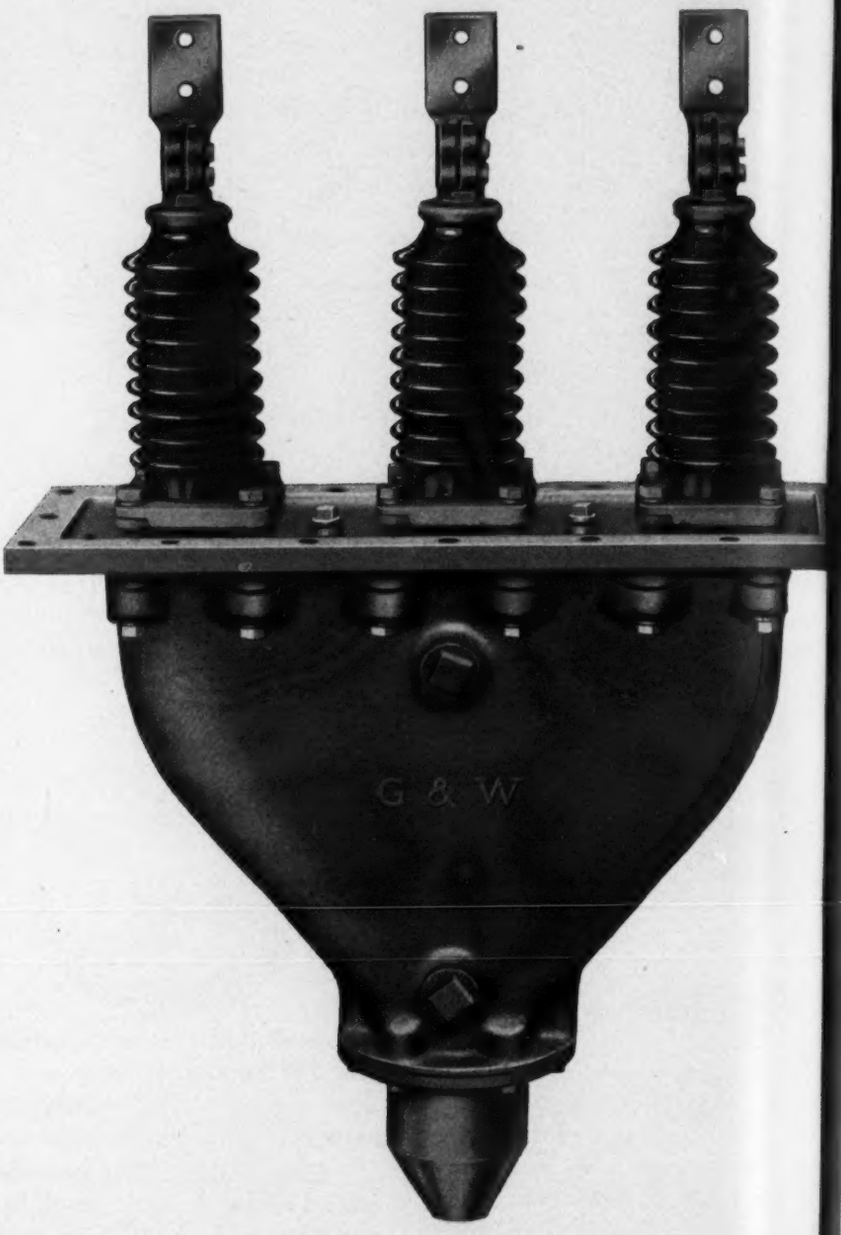


The True Four-Wheel-Drive Principle With Center Differential Asks Less In: Tires—Gas—Oil—Replacements.

THE OLDEST AND ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

What in this world is

We cannot say that G & W POTHEADS are permanent—they might be struck by lightning—a storm or accident might damage them. But we can say that the materials used in the makeup of G & W POTHEADS are as permanent as anything known to man. . . . Porcelain does not wear out. Cast iron does not rust—more than superficially. Copper alloys endure for ages. Carbon compound gaskets last indefinitely (as used). There is nothing else in G & W POTHEADS except good workmanship.



G & W RESISTOYL GASKETS

AND PROPERLY DESIGNED JOINTS HAVE SOLVED THE PROBLEM OF MAINTAINING TIGHT POTHEADS

G & W CAPNUT TERMINAL POTHEADS

OIL-TIGHT —— WATER TIGHT —— VACUUM-TIGHT

REDUCE OUTAGES BY HERMETICALLY SEALING CABLE ENDS

PERMANENT

PROTECTION TO CABLE ENDS IS THE PRIMARY PURPOSE OF G & W POTHEADS

SUGGESTION FOR EQUIPMENT NOW IN SERVICE

Check your old equipment for gasket troubles. — If gaskets are of obsolete material and show signs of leakage due to deterioration, replace them with G & W "RESISTOYL" — a tough, flexible rubber-base compound, heavily impregnated with amorphous carbon. Clamped between flanges, it withstands oil, water and acid fumes.

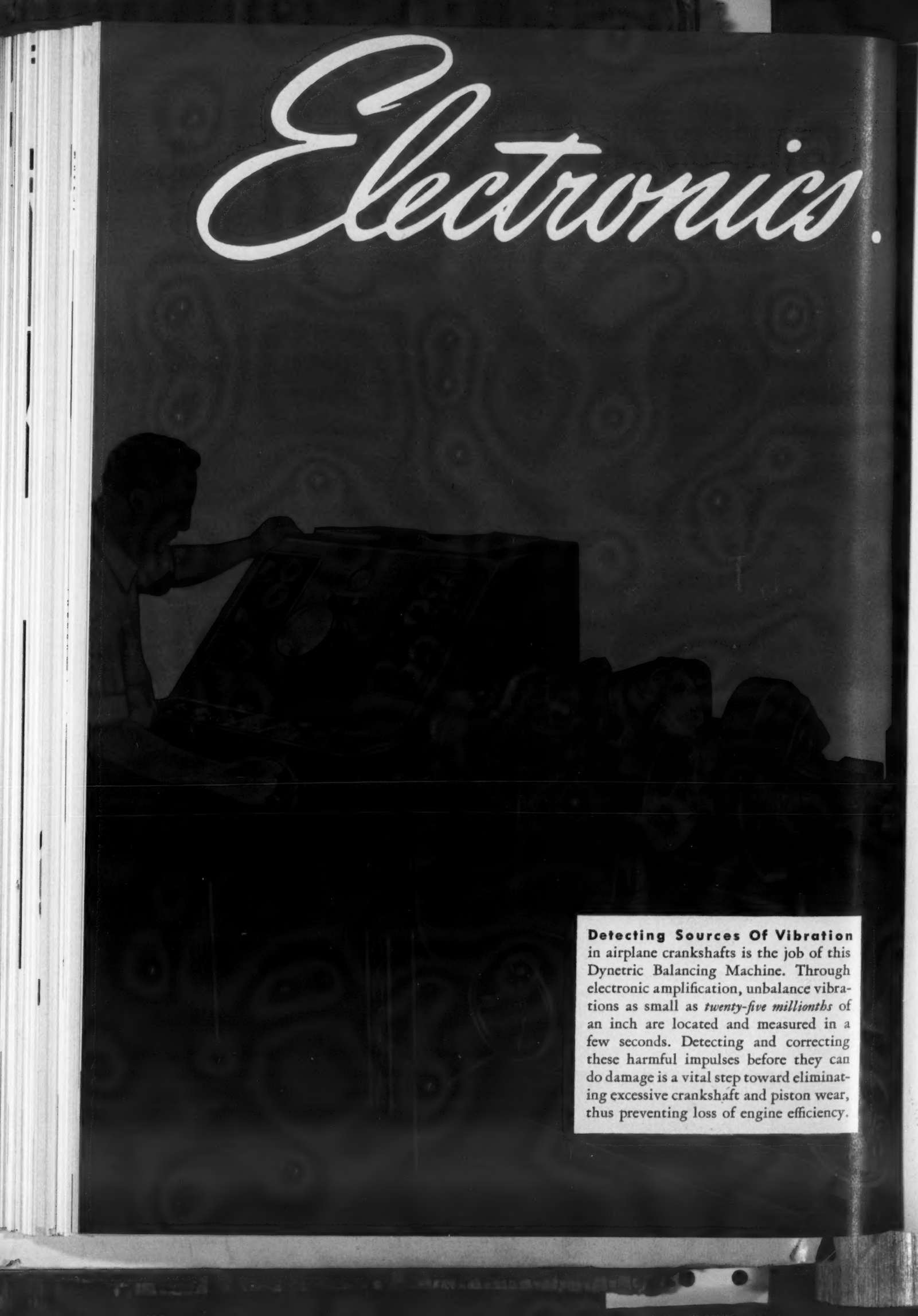
G&W ELECTRIC CABLE DEVICES

POTHEADS . . . UNDERGROUND CABLE BOXES . . . MULTITAPS
OIL FUSE CUTOUTS . . . SUBWAY OIL DISCONNECTS & SWITCHES

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE — CHICAGO, ILLINOIS

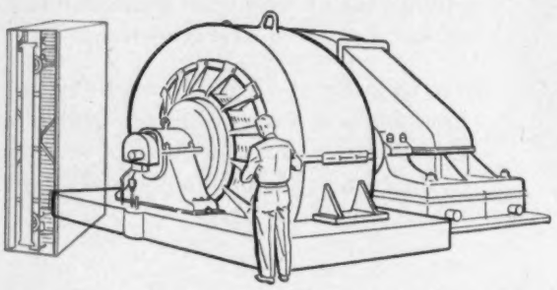
Also made in Canada by POWERLITE DEVICES, LTD., Toronto.



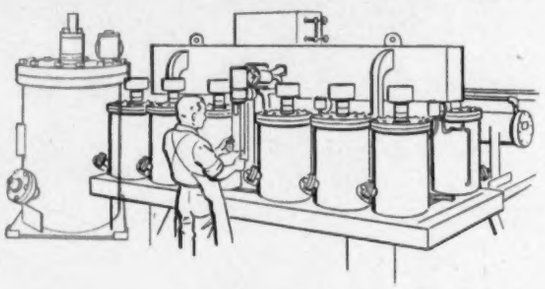
Detecting Sources Of Vibration in airplane crankshafts is the job of this Dynetric Balancing Machine. Through electronic amplification, unbalance vibrations as small as *twenty-five millionths* of an inch are located and measured in a few seconds. Detecting and correcting these harmful impulses before they can do damage is a vital step toward eliminating excessive crankshaft and piston wear, thus preventing loss of engine efficiency.

. . . at Work

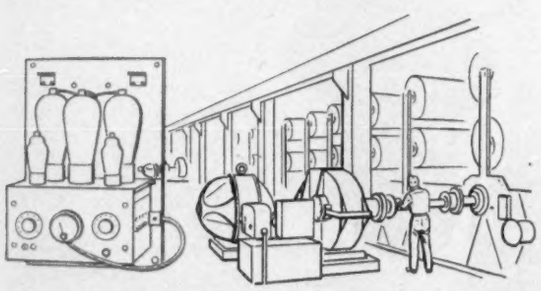
Electronic devices are at work today in practically every war industry. They are helping to roll back old limits on production capacity—saving time, cutting costs, improving products. Here are typical examples from a long list of practical applications—showing how and where you'll find Westinghouse "Electronics at Work."



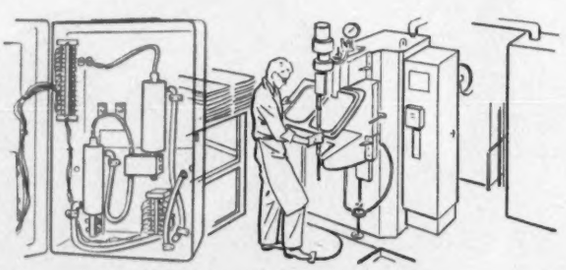
Cleaning the Air in steel mill motor-rooms is one of many applications of the PRECIPITRON, Westinghouse electric air cleaner. By trapping air-borne dust, dirt and soot—including particles as small as 1/250,000 of an inch—it prevents damaging dirt from settling in machine windings. Result: Increased operating efficiency, fewer shutdowns for maintenance.



In Aluminum Production, large quantities of d-c power are required. The Ignitron Rectifier, electronic device developed by Westinghouse, converts alternating current to direct current at *higher efficiency* than any other type of equipment. It carries rated loads continuously—24 hours a day. Because there are no major moving parts, maintenance is practically eliminated.



Highly Accurate Control of motor performance is essential for uniformity of product in the paper and other process industries. By Electronic means, more precise control of speed, voltage, acceleration, and other characteristics can be obtained. The absence of any moving parts permits maintaining the highest possible degree of sensitivity, without the necessity of frequent maintenance.



Mass-Production Welding has been made possible largely through the development of modern resistance welding techniques. By this method, metal parts are now fabricated far faster than ever before. To deliver high-quality welds of uniform strength, accurately controlled current must stab through the metal as often as 1800 times a minute. In scores of plants, Westinghouse Electronic Timers provide this precision control.

J-91007

For further information on practical applications of Westinghouse Electronic devices, write or phone your nearest Westinghouse office. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

WESTINGHOUSE

Westinghouse ELECTRONICS

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

"Thanks for helping"

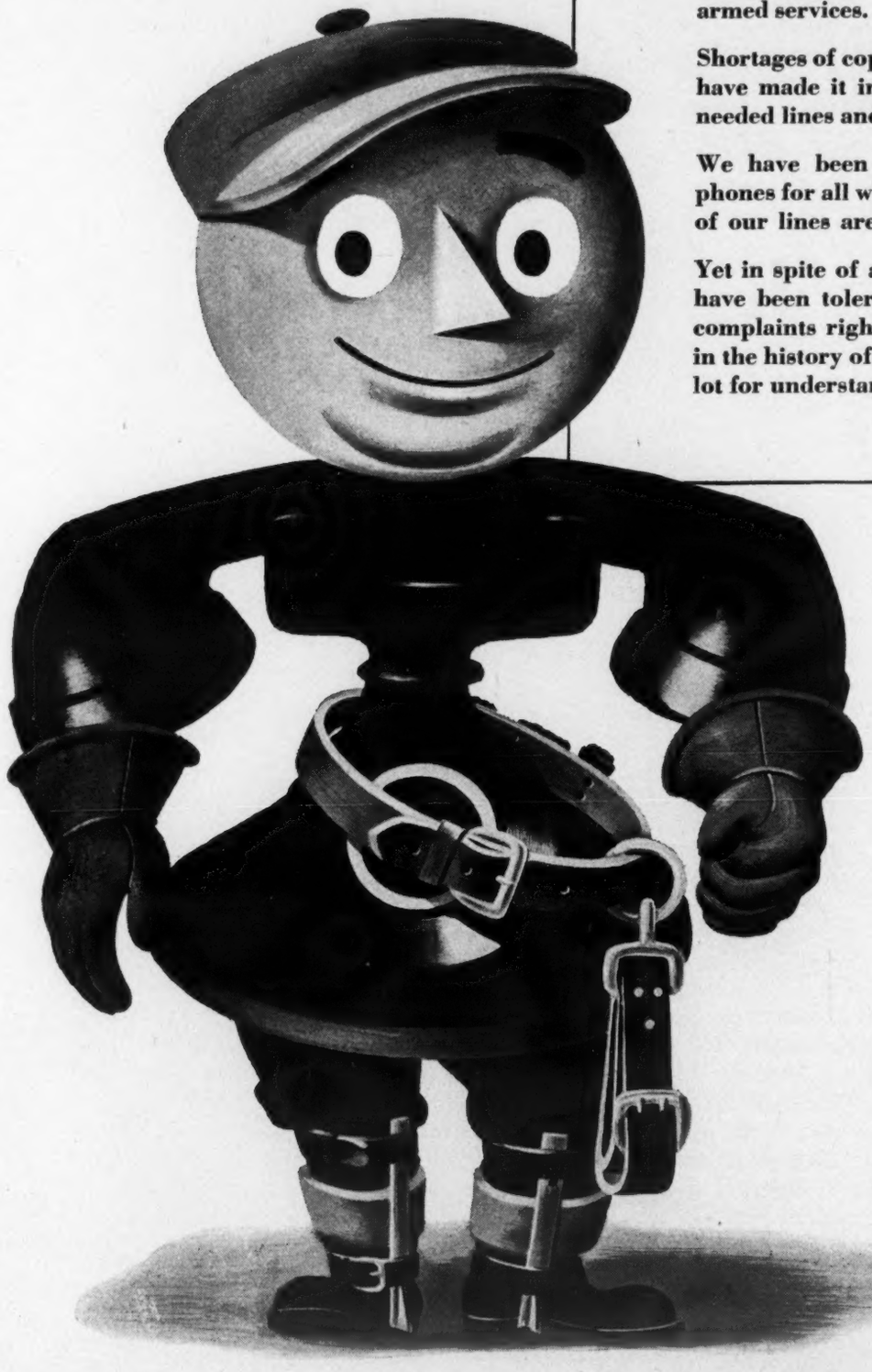
We are grateful for your help in difficult times.

Here in the Bell System we have seen some 43,000 of our people go into the armed services.

Shortages of copper and other materials have made it impossible to add much-needed lines and equipment.

We have been unable to install telephones for all who want them and many of our lines are overcrowded.

Yet in spite of all this, telephone users have been tolerant and we have fewer complaints right now than at any time in the history of the business. Thanks a lot for understanding.



BELL TELEPHONE SYSTEM

WAR CALLS COME FIRST

ENGINEERED

for Better Hanging of Power Piping

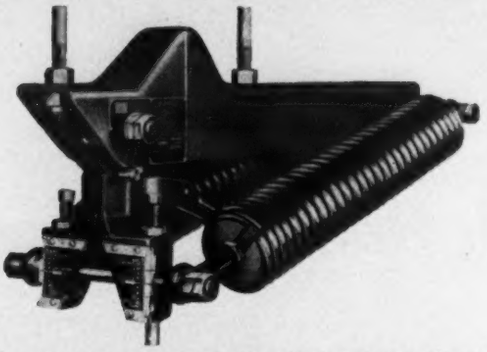
GENSPRING Constant-Support Hangers are custom-made from standard parts . . . pre-fitted to each installation!

• • •

Write for Data Book containing complete details of GENSPRING Constant-Support Hangers for loads from 250 to 8,500 lbs. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

FOR CONSTANT SUPPORT...

Through exclusive patented design, GENSPRING Hangers provide *constant support* for power piping in all "hot" and "cold" positions. The full safety factor of the supported system is always maintained.

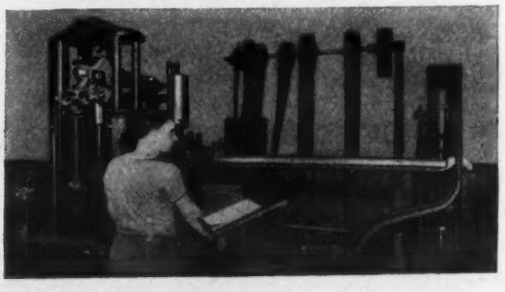


FOR FAST PRODUCTION...

GENSPRING Constant-Support Hangers are manufactured by efficient mass-production methods. Every unit is engineered to the user's specifications, then assembled from standard precision parts.

FOR PERFORMANCE...

Each GENSPRING Constant-Support Hanger is *pre-tested and calibrated* under conditions that duplicate its actual-service requirement. There's no need for load adjustment on the job . . . no chance of misfit hanger installations.



GENSPRING CONSTANT-SUPPORT HANGERS BY **GRINNELL**

WHENEVER **PIPING** IS INVOLVED

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO

100% WAR PRODUCTION AT CRESCENT

is Helping To Preserve The Light of Safety

Into practically every type of war equipment—airplanes, tanks, ships, trucks—goes insulated wire and cable. In many cases a part of this most necessary product was made at the CRESCENT Plant.

CRESCENT INSULATED WIRE & CABLE

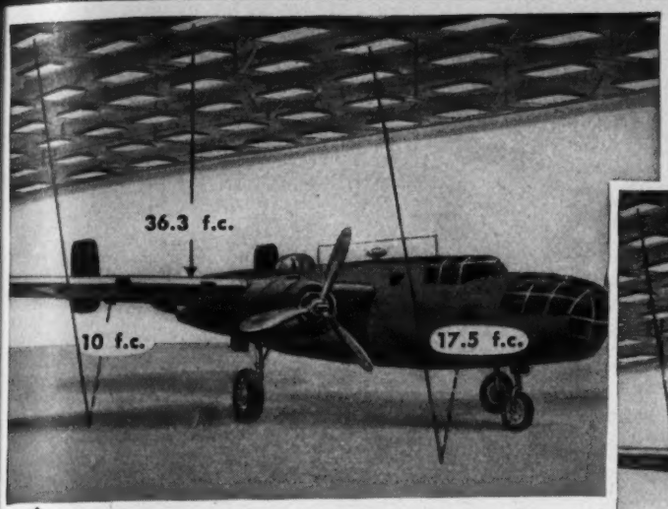
CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

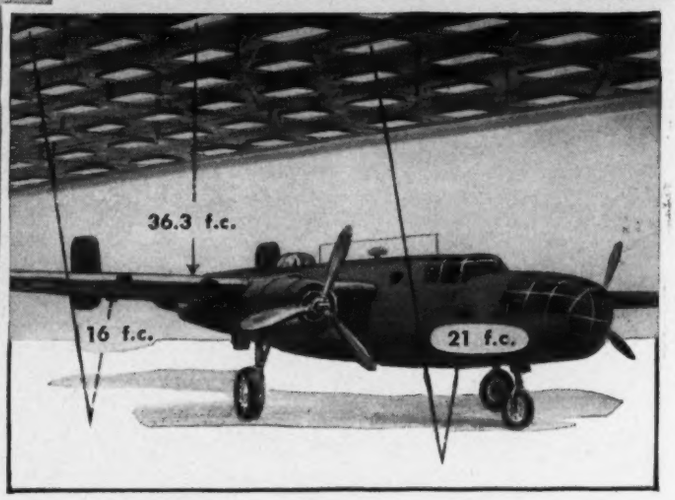
How Light-Reflecting Floors Increase Lighting Efficiency

Light-colored concrete floors made with Atlas *White* portland cement reduce contrasts and shadows . . . increase illumination on vertical faces and undersurfaces . . . enable industry to use light more efficiently, more comfortably.



GRAY-CEMENT FLOOR
Reflection factor 27.4 per cent.

WHITE-CEMENT FLOOR
Reflection factor 44.0 per cent.



CONCRETE FLOORS made with Atlas *White* portland cement have a higher reflection factor than floors made with *gray* portland cement or other darker materials. This reduces contrast in brightness and thus enables industry to use increasingly higher levels of illumination with greater effectiveness, efficiency and comfort.

In addition, light-colored concrete floors made with white cement increase illumination on vertical faces and undersurfaces. This is shown in aircraft plants for Boeing, Consolidated, Douglas, North American and elsewhere. In one of these leading plants, where horizontal illumination is 36.3 footcandles, the gray-cement floor (see diagram) reflects 10 footcandles onto undersurfaces, but the white-cement floor in the same plant reflects 16 footcandles onto these surfaces. That's 60% more light from the white-cement floors. Compared with a still darker floor, the increase would be much more.

Tests in the same plant also show that the white-cement floor reflects 20% more light to *vertical* work surfaces. Compared with still darker floors, this increase would be even greater.

Today, Universal Atlas Cement Company joins you in promoting "Better Light—Better Sight." Our salesmen, our literature, and our advertising join you in telling the story of better light to your customers . . . to architects, engineers, factory superintendents, executives. For details fill in the coupon for your copy of the new book, "Light from Floors." Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York, New York.

• • •

OFFICES: *New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.*

ATLAS WHITE CEMENT
FOR LIGHT-REFLECTING FLOORS

Universal Atlas Cement Company, Chrysler Building, New York, N. Y.

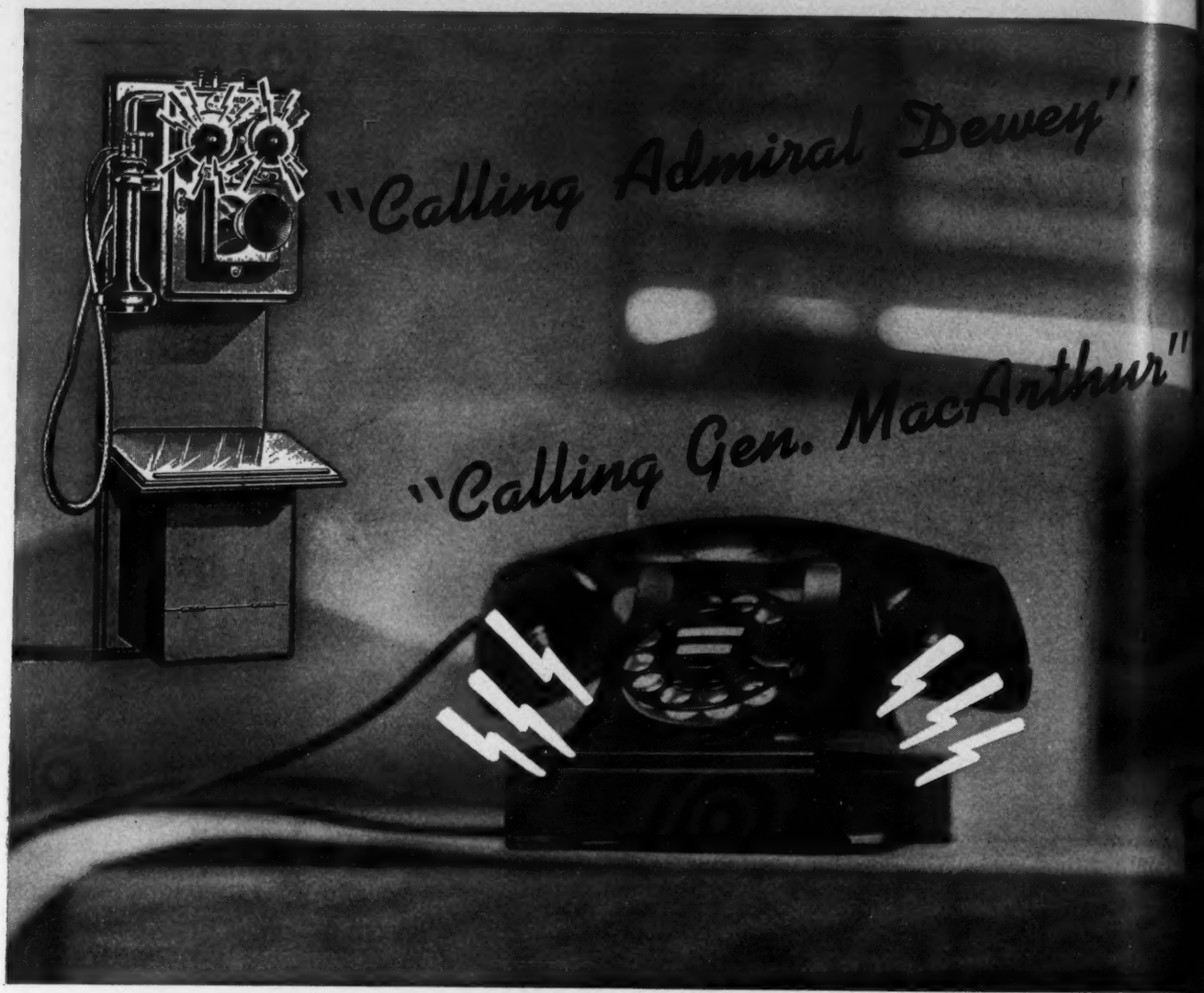
Please send me copy of new book, "Light from Floors." KW-F-13

Name_____

Position_____

Company_____

Address_____



C-D INSULATION *helped complete both calls . . . . . .*

BETWEEN that wall-hung "stem winder" and today's radio telephony, America's best technical minds have made the telephone as vital an instrument of war as it is of peace . . . With its development and world-wide use, CONTINENTAL-DIAMOND has been closely associated from the very beginning—always ready with the kind of insulating materials that would promote long distance efficiency and simplify instrument design.

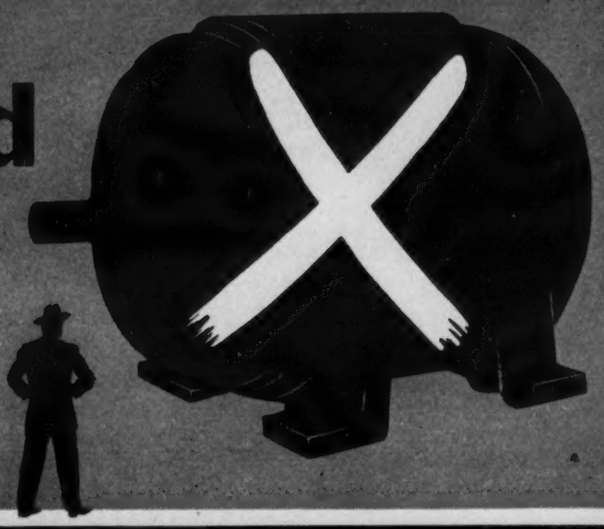
When conditions permit your phone compan to put their post war plans and designs into effe you will find that new and better C-D insulatio has again aided in the never-ending search f perfect service.

Our Research Laboratory and its staff of Ele trical and Insulating Engineers is at your dispos for the development of things to come. Write u without thought of obligation.

Continental-Diamond FIBRE COMPANY

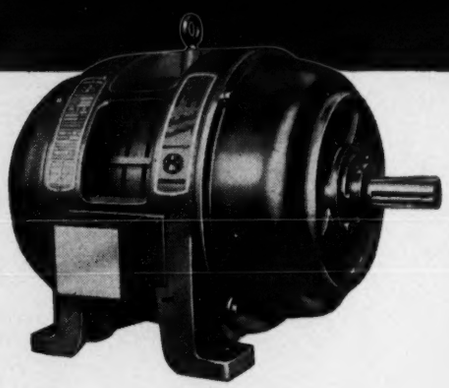
Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

You don't need Extra Size



With this Extra Quality

Copperspun



• No need to tell you that wartime restrictions make it impossible for you to get extra-size or extra-horsepower motors for any job that calls for specific horsepower.

But don't let that worry you for a single moment. Put Fairbanks-Morse Motors with Copperspun Rotors on the job—and you *do not need* extra horsepower or extra size.

The reason, briefly stated, is this: The winding of the F-M Copperspun Rotor is centrifugally cast, in *one piece,* of pure *copper.* No other rotor is cast of *copper.* Copper has better thermal characteristics. Copper has better electrical characteristics. For these reasons, you can run a Fairbanks-Morse Motor with Copperspun Rotor *under full load indefinitely* without danger of damage through overload.

Naturally you'd rather not buy horsepower you don't need — if you can do so safely. Now you can.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago. Branches with service stations throughout the United States and Canada.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

F M

Motors

The Red Cross has Problems like your own

—*of Planning*

Your Red Cross operates a vast planning program to enable it to be ready for any disaster or emergency anywhere—whether it comes in the Americas, Europe, Australia, Asia, or Africa.

—*of Organization*

Your Red Cross is responsible for the smooth operation of 3,750 chapters and 6,000 branches, all engaged in the same enterprise of helping all who need help.

—*of Personnel*

Your Red Cross has tripled its staff since Pearl Harbor and has had to enlist the aid of and train over 6,000,000 volunteers in the principles of First Aid, Water Safety, Accident Prevention, Home Nursing, Nutrition, Nurse's Aideing, Mass Feeding, Motor Mechanics, and other subjects allied to our country's war effort.

—*of Production*

Your Red Cross is not only one of the world's foremost purchasers of supplies, but it has the immense distribution job of collecting millions of items from 10,000 different communities in the United States, assembling and storing them, and then shipping them to practically every country in the world. Last year your Red Cross shipped some $60,000,000 worth of food, clothing, and medical supplies to over 20,000,000 homeless people in foreign countries.

—*of Finance*

Your Red Cross, whose war-time and post-war expenses will run well into hundreds of millions, must account to the public for every penny it collects and puts to work. Its accounts are audited annually by the U.S. War Department.

The Red Cross faces the same problems as are in your business. With your support it can successfully meet them.

The Second War Fund is greater than the First, but no greater than the increased needs.

Business men can help with time and with money, as organizations and as individuals.

March is the Red Cross month . . . Cooperate with your Red Cross Chapter.

Your Dollars help make possible the

AMERICAN RED CROSS

ILLINOIS

INDOOR BUS SUPPORT PORCELAINS

HIGH MECHANICAL STRENGTH

HIGH DIELECTRIC STRENGTH

EXACT DIMENSIONS AND UNIFORMITY

ILLINOIS ELECTRIC PORCELAIN CO., MACOMB, ILLINOIS

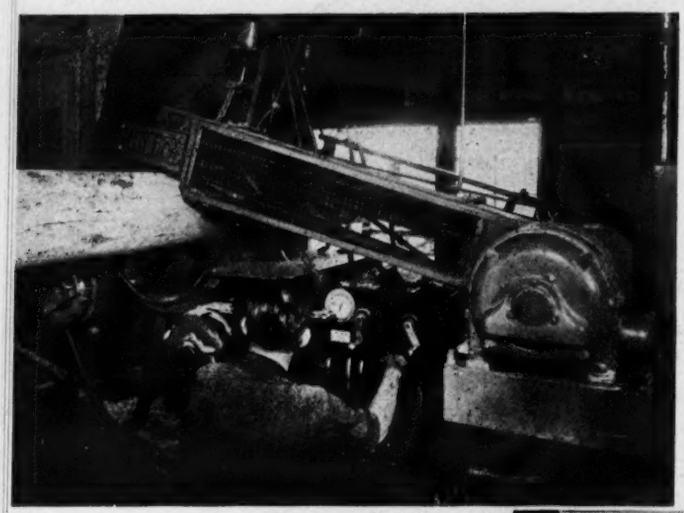
BELL "Long-Life"

SELKIRK RANGE HIGH ALTITUDE

★ Full Length Machine Shaved

★ Full Length Treated & Sterilized

BELL Poles all go through a specially designed incising machine where the ground line area is subjected to a fibre spreading process so that maximum penetration with No. 1 A.W.P.A. creosote oil is assured. This is but one of the important steps in the preparation of BELL Long-Life Cedar Poles. Section of pole above shows even and full sapwood penetration.



Two "Long-Life" Processes for the preservative treatment of Western Red Cedar Poles over their full length are available in our plant. Through these scientific methods the unusual service life of Bell's specially selected timber is increased and your maintenance cost for pole lines is materially reduced.

BELL "Long-Life" Processed Poles have all knots shaved level with pole surface. This gives you an added safety factor for linemen as it eliminates the possibility of slipping spurs.

BELL operates two large treating plants and three concentrating yards. All operations are conducted under the personal direction of the president of the company. The two large BELL treating plants are equipped with the very latest machinery to obtain the maximum in quality results. Included are power-driven machines for roofing, gaining, and boring.

Through each step in BELL production, skilled workmen perform under careful supervision and close inspections follow each operation. Precision Control is a paramount feature in the production of BELL Poles.

The specially designed Shaving Machine (above) assures absolute control of the cutting depth to provide any thickness of sapwood desired by customers. (We recommend not less than 3/8"). Shaving is the first step in the BELL completely modern method of producing better appearing and longer lasting poles.

After shaving, framing and butt treatment, the poles are immersed in full length dipping tanks, getting the advantage of full length heat sterilization plus toxic preservative—it is added protection against rot and infestation.

The incising machines (picture at far right) used exclusively by BELL for the "BELL Guaranteed Half-Inch or Full Sapwood" treatment leaves no sliverings, abrasions, or loosened sapwood and preserves the original pole strength by *spreading* fibres instead of crushing or breaking them down.

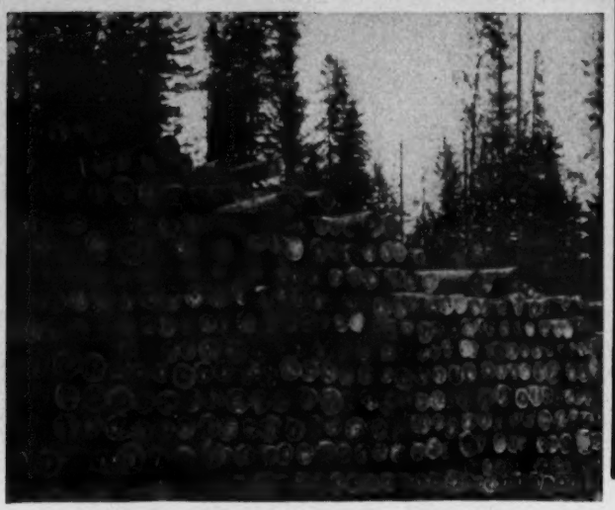
★ Buy United States Government "attack" bonds today for the sake of your dollars tomorrow.

BELL WESTERN RED CEDAR NORTHERN WHITE

PROCESSED

WESTERN RED CEDAR POLES

- ★ High Tensile Strength
- ★ Greater Shock Resistance
- ★ Longer Service Expectancy



BELL Lumber & Pole Company owns its own timber, thousands of acres of Cedar Forest in the interior Selkirk Range high altitude areas of the Rocky Mountains. All timber is strip-piled right where it is felled to get advantage of slow moisture evaporation. This insures even seasoning and control of checking.

"Long-Life" Process No. 1

By this method of full-length preservative treatment, the poles are first *machine-shaved* from tip of pole to ground line distance from extreme butt end, are made perfectly smooth, with all knot projections eliminated, "turned" as though by a lathe, but finished with natural taper and contour of the timber. Sapwood thickness, after shaving, is provided to an average ⅜" thickness, and the pole is then given an hour continuous immersion in A.W.P.A. specification creosote oil maintained at constant heat of 230 degrees Fahrenheit—an ultimately dry, mighty fine appearing and well preserved pole. Poles subjected to Full Length Process No. 1, are worth the slight additional cost for this treatment, and emphatically preferable for use in localities or locations where full length stained or painted poles are desired or required.

"Long-Life" Process No. 2

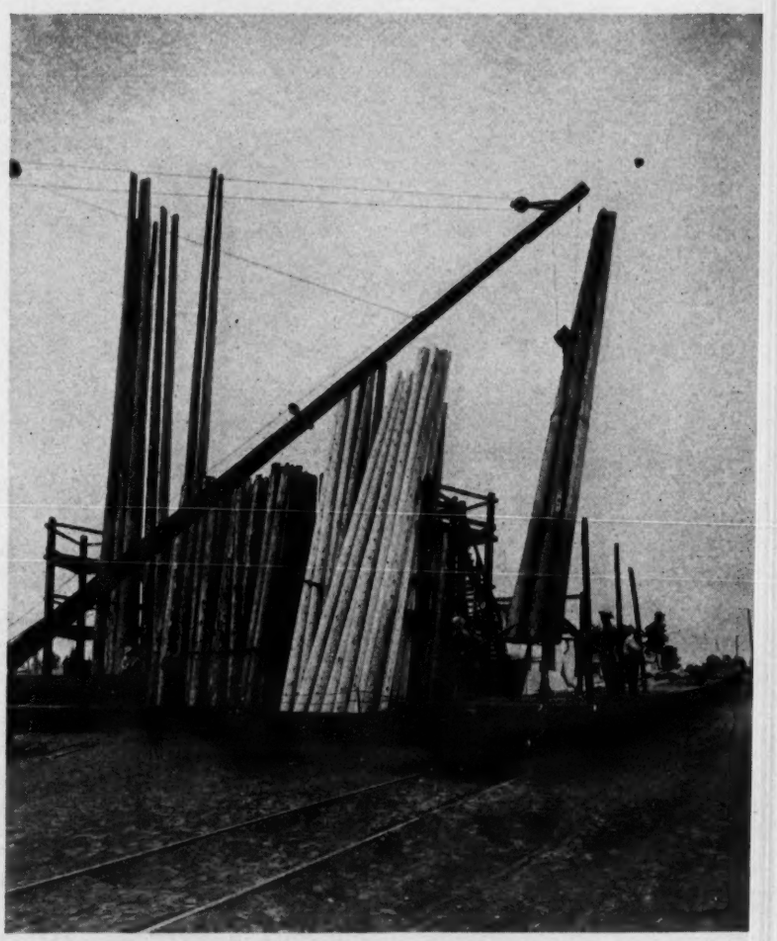
In this process, preliminary preparation of the pole for subsequent treatment is exactly the same as for Process No. 1, *but* the pole is full-length preservative treated, from tip to extreme end, by immersion in specially designed tanks, in A.W.P.A. specification creosote oil, first for an *eight*-hour period in preservative maintained at 230 degree heat, then for a *two*-hour period in cold oil, followed by a *one*-hour period in hot oil maintained at 230 degrees heat. This results in a pole *thoroughly* protected against *any* possible fungi attack—sterilized from top to bottom—a *dry* pole, *completely* manufactured, that *is* RIGHT. Tests have proven this "Process No. 2 Treatment" results in practically complete preservation of the ⅜" sapwood to total thickness—with a test absorption of 48 lbs. of preservative for each cubic foot of sapwood treated (the heartwood of cedar will not take treatment and, because of natural toxicity does not need it). For a *sure thing* in long service life this is the treatment—it is supreme.

Greater Strength—because of natural growth density.

Greater Shock Resistance—because of more compact fibre structure.

Longer Life Expectancy—because of the thinner sapwood in proportion to total cubical wood volume and greater proportion of natural toxic, decay-resisting heartwood.

Perfect Pole Requisites—because they possess extraordinary stability, are light in weight, have low conductivity, permit spans of greater length, carry heavier loads, have very even taper, are straight and possess unusual elasticity.



This picture shows a close-up of BELL pole butt treating tanks. There are two large BELL treating plants equipped with these tanks.

BELL 1943 LBR. & POLE CO.

BELL LUMBER & POLE CO.

Minneapolis, Minn.

General of the United States, in special statements prepared for *Textile World*, and in addresses before textile groups, has stated that the cooperation of the textile industry has been outstanding and that the industry has kept ahead of schedule on all the major types of fabrics required.

General Gregory recently pointed out that of the approximately 234,000,000 yards of combed twill produced in this country in 1942, the Army took about 87%, the Navy 10%, leaving 3% for non-military purposes.

Col. Robert T. Stevens, of the Quartermaster Corps, in a recent address, referred to the output of duck. Production of that vital military fabric was twice doubled in six months, between January and July 1942, he said, and an annual capacity of 600,000,000 yards of all types of duck was made available. "The current rate of production of cotton duck is five times normal," said Col. Stevens, "and 38% comes from converted carpet, plush and upholstery mills. Based upon known requirements, production in this field is fully adequate".

"Fully adequate" is high praise when it refers to duck production. At the outbreak of the war it looked as if there was no possible chance of meeting requirements, at least during the first year. Nor would there have been if other types of mills had not shifted to making this fabric, and if experienced duck manufacturers had not gone "all-out" in teaching the newcomers, potential post-war competitors, everything they knew about the manufacture of duck. American industry offers many such examples of unselfish cooperation.

Another outstanding accomplishment, made necessary by the interruption of burlap imports, was the conversion of looms producing peacetime fabrics to the production of bag fabrics. The tremendous demand for sandbags, camouflage cloth, food, agricultural and other bagging, caused a conversion order to be issued for the purpose of raising the annual production rate of osnaburg from 263,500,000 yards to 660,000,000 yards, and bag sheeting from a rate of 488,000,000 yards to 855,000,000 yards. The result of this order, and of the military schedules already in effect, was to put the cotton weaving industry about 88% into war, essential industrial, and essential civilian production.

Plant conversion went on with feverish speed. Carpet looms were swung to blankets and duck; the lace industry turned to mosquito netting and insect netting of which it produced millions of yards. The flat-knitting industry with its tricot machines also is engaged in the manufacture of mosquito netting. The sewing thread industry was converted to the production of combed yarns. What once was the silk industry is now doing a tremendous amount of war work. Those mills which had equipped themselves for throwing Nylon yarns for hosiery are now throwing the Nylon for parachutes. That section of the silk industry that was equipped for weaving rayon fabrics is producing fabrics of high-tenacity rayon for flare chutes, cargo chutes and delivery chutes. Many silk and rayon looms that formerly wove clothing materials are now weaving parachute fabrics.

Today practically all Nylon is used for military purposes and the bulk of high-tenacity rayon goes into military fabrics.

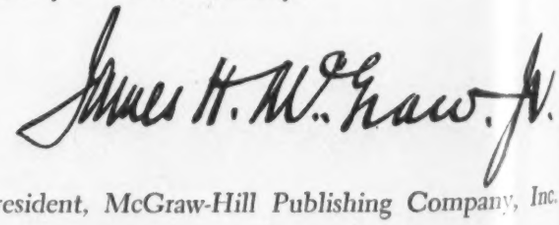
Above and beyond all the new developments is the gigantic job of producing millions of yards of standard fabrics of many colors and weaves. To produce all the uniform fabrics and blankets is in itself quite a job. The woolen and worsted industry has been doing it magnificently. Tent fabrics and summer fabrics produced by the cotton industry are no less a formidable assignment. I could point to myriad other jobs no less impressive.

The production man can indeed take pride in this record and behind the production man, the textile technician has been working tirelessly. Mildewproofing and waterproofing, so vital in a world at war, are in a new stage of effectiveness. A new process for waterproofing fabrics employs vinyl acetal plastic in place of precious rubber. Textiles that glow in the dark have been perfected for black-outs and other applications. American genius is solving problems many of which seemed insurmountable. Silk, for example, was something the Japanese thought we could never duplicate. A new synthetic textile filament that weighs but one eighth of the finest silk filament threatens to put the Japanese silkworm out of business after the war so far as we are concerned. The post-war possibilities of this development challenge the imagination.

Nor has the primary textile industry been alone in its contribution to the war. The textile machinery industry has been converted almost entirely to war work, save for a few facilities required to relieve extreme bottlenecks and supply essential maintenance and repair-parts.

Similarly, some textile mills, particularly hosiery mills hard hit by the silk and Nylon cut-off, are utilizing their space and skilled staffs to produce parts for war equipment.

The immediate significance of all this is its importance in the winning of the war. There is, however, a post-war implication which is important to the future of America. A mass production textile industry will serve civilians after the war more effectively than ever before, and will put new standards within the reach of millions. A long step has been taken toward that completely synthetic textile industry which some observers see in the future. The tempo of such changes has been accelerated tremendously. The oldest industry in the world, now one of America's largest, is showing a youth and vigor that promise much for the future... nationally and internationally.



President, McGraw-Hill Publishing Company, Inc.

Without Equivocation

The power men should be proud of the job that has been done in providing power supply. Power has never been "too little or too late." There is today no shortage of power. This is in sharp contrast to the situation as to many other vital necessities. I do not know of a single instance in which the operation of a plant has been delayed by lack of electric power supply.

Those are the words of J. A. Krug, director of the Office of War Utilities, taken from a speech made by him last month in Chattanooga before the TVA distributors. These are the words of the man who this week became the third man in WPB and who has been and will be in a position to gauge the full meaning of such an unequivocal statement.

These words should end the senseless argument of the past several years that a power shortage was imminent. This mirage, always two years away, is now officially a myth.

Strangely enough, however, when Ickes, Olds, *et al.*, screamed power shortage, though they had repeatedly cried "Wolf, wolf," the daily press, every time, gave them headlines. Now, however, when one who knows states that everything is under control, his words do not carry beyond the sound of his voice.

It is not that threatened disaster only is news, for in these days of rationed this and rationed that it is news to find something that is still plentiful. The talk, unfortunately, came at a time when other more exciting WP news was breaking.

In spite of the fact that the speech did not get good publicity, this was a courageous statement for Mr. Krug to make, for it was in effect a challenge to the credibility of powerful political forces that had sought not to let the war interfere with their own programs. Under these circumstances it would be a pity for these brave words not to get to the public.

Though the statement was made more than two weeks ago, the information is still news, and each day more that the public struggles with ration points it will be more welcome news.

This isn't any Army-Navy "E," but in some ways it is even greater. What other industry has had the honor of being told that no war production has been held up for want of its product? And to it we might add, without civilian rationing.

Power men can feel proud. It is the kind of pride, however, that should find outlet in trying to do a still better job. At the same time the public is entitled to know the facts if only for the encouragement they would bring.

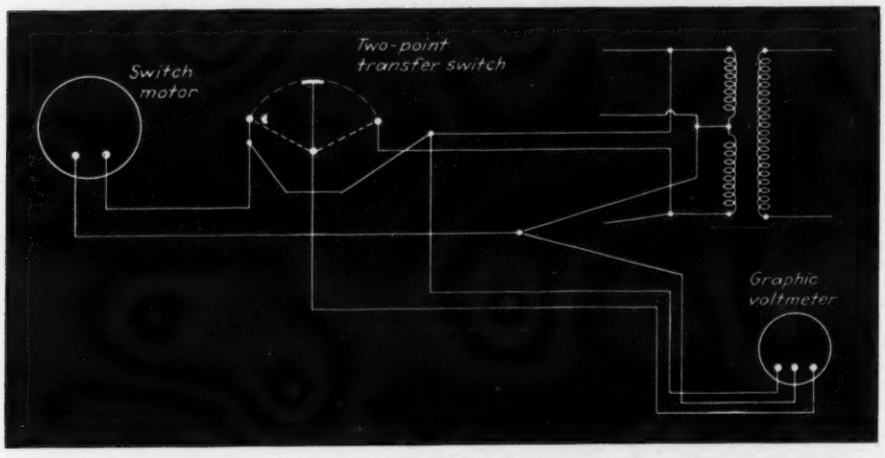
For the first time in more than a decade an official high in public office has praised the power industry without any equivocation. It's refreshing. Let's get the news to the public.

Minimum of Graphic Equipment Yields Maximum of Data

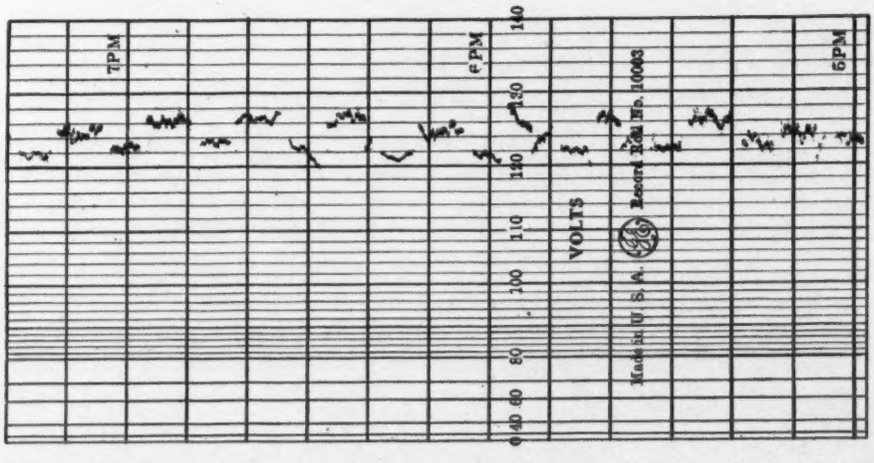
Graphic meters supplemented by transfer switches record serially up to four traces on single chart in load and voltage surveys — Provides for more comprehensive determination of facts; conserves meters and saves man-hours of test time

GUY H. KELSAY, Electrical Engineer with Indianapolis Power & Light Co., Indianapolis, Ind.

FOR the past two years Indianapolis Power & Light Company has been making load and voltage surveys using standard graphic meters supplemented by "transfer switches" to shift the graphic meter connections from phase to phase alternately, on polyphase service; from side to side, alternately, on single-phase, three-wire service or from in-phase to 90 deg. lag, in regular sequence, to record watts and vars. The transfer switches are synchronous motor operated.



TWO-POINT voltage-transfer switch applied to single-phase, three-wire circuit records voltages to neutral on two halves of circuit. Can be used to chart any two related voltages, as on the two sides of a voltage regulator



TYPICAL voltmeter chart of two voltages

Two-point, three-point and four-point voltage and three-point current transfer switches have been used. The number of points indicates the number of switch points available and therefore the number of traces obtainable with one switch on a single meter chart.

Use of transfer switches in this manner has pronounced value over (1) the use of two, three or more separate, continuous traces recorded with as many meters or (2) the repeated use of the same meter. Interpretation of data from two or more meters involves slow and tedious work in lining up and making allowances for chart speeds and errors in obtaining values from separate charts. Where all data are on one chart, quantities are close together and regularly recorded. This contributes to faster and more comprehensive determination of facts. Errors in chart speed may in most cases be fully corrected, because the transfer switches go through definite cycles in a definite time and an error in chart speed will but rarely destroy the value of the chart. There is also a distinct economy in meter investment—a major cost in load and voltage surveys—and a definite saving in man-hours of test time for equal data obtained.

Two-Point Voltage Switch

A number of the more common transfer switch combinations and their applications will be discussed in detail.

Two-point voltage switch applications include (1) single-phase, three-wire service voltage investigations at residential service switches, and (2) single-phase feeder voltage regulator studies with the voltmeter connected alternately to the primary on each side of the regulator.

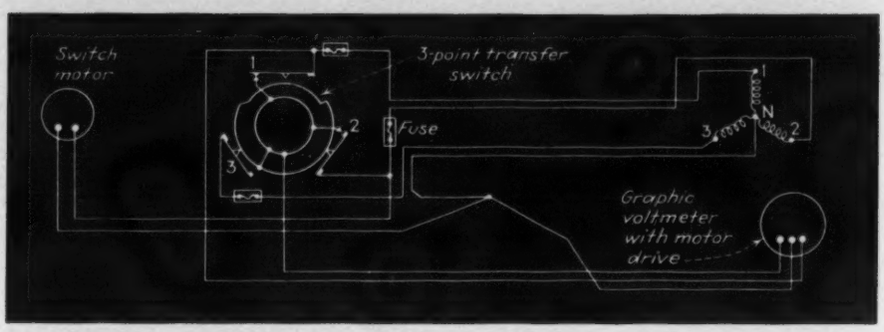
Connections for use of the two-point switch on single-phase, three-wire circuits are shown in an accompanying diagram. For this application the chart shows a series of two voltage values, made on fifteen-minute intervals with 1½ minutes between series and ½ minute between voltage traces of the two sides of the circuit. Voltage is recorded for 5½ minutes on one side and for 7½ minutes on the other. Length of intervals and their position in relation to the 1½ minute "off" position identifies either "side" voltage. When the meter pointer returns to zero, between traces, it identifies the traces by dots and dashes.

Voltage Range Reflected

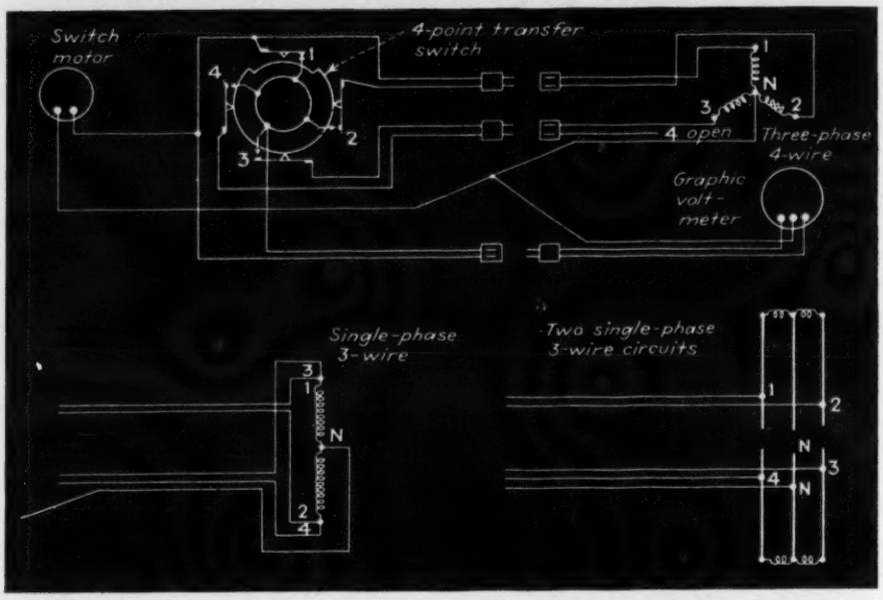
At the start of each test each trace is labeled for a cycle or two as to which side of the circuit each represents. Thus from the chart, voltages to neutral from each side are determined. Data are thus obtained on voltage unbalance showing the cause and need for load balancing.

By using the two-point transfer switch, records of primary voltage on the sides of a single-phase feeder voltage regulator can be obtained. These give a record of regulator performance. Difference between the two traces reflects the range of voltage through which the regulator is working, or if "source-side" voltage is too low for the regulator to raise the trace will show the extent and time that the regulator does not supply adequate service. Where a regulator is compensating for voltage based on load a trace of the current may be taken simultaneously with the voltage traces and the story of performance will be quite complete.

For a three-phase regulator installation one graphic ammeter may be used with a three-point current switch (to be described later) and three graphic voltmeters each with a two-point voltage switch to obtain a very complete record of the regulator performance. Data so obtained, in addition to giving the performance of the regulator, give the current balance on the circuit and are helpful in determining if the regulator is properly located in relation to distance on the circuit.



THREE-POINT voltage-transfer switch used to obtain record of any three related voltages as the primary of a transformer and the two sides of its three-wire secondary or the phases of a three-phase circuit



FOUR-POINT voltage-transfer switch for four related voltages as on three-phase, four-wire, or single-phase, three-wire circuits or two adjacent single-phase, three-wire circuits

Three-Point Voltage Switch

Several applications of the three-point switch arrangement are possible. In one a graphic meter records the primary voltage at a single-phase transformer location and each side of the three-wire service on the secondary side of the transformer. The following information is revealed by a chart of this kind.

(a) Value of primary voltage sustained throughout the test.

(b) How each side secondary voltage is sustained.

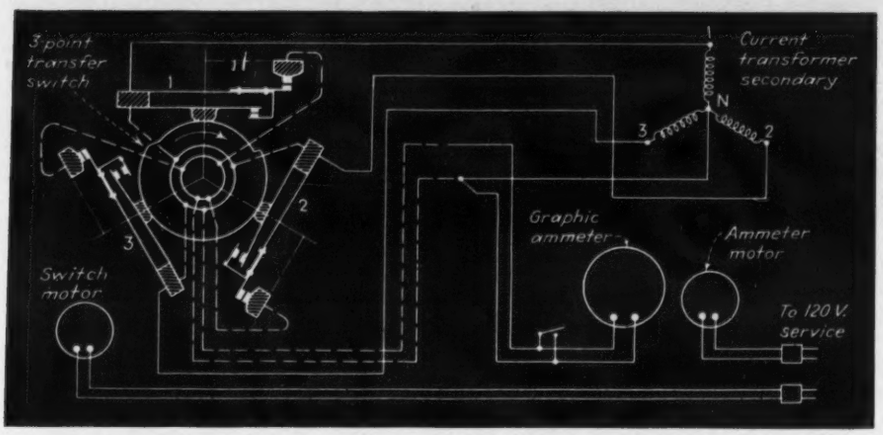
(c) Difference between primary and secondary of each side reflects transformer regulation.

(d) Extent of transformer load unbalance. Difference between primary and secondary voltage is a measure of the transformer loading. If not the same for each side of the transformer, difference reflects the extent of transformer load unbalance.

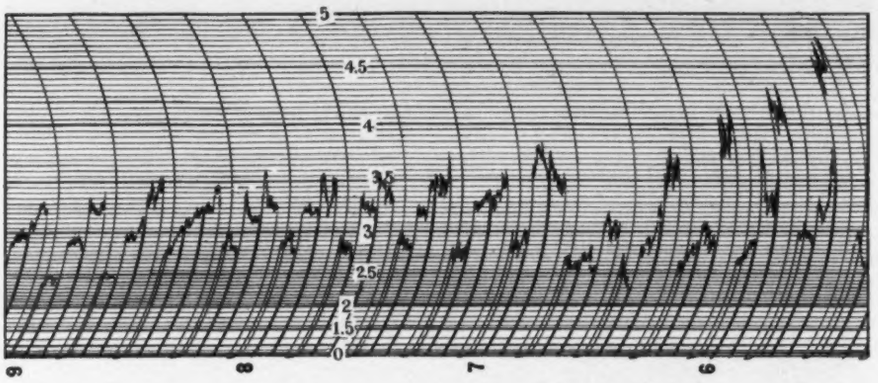
(e) Extent of secondary load unbalance. A difference in magnitude of secondary traces reflects unbalance.

(f) Relative values of the primary and secondary traces may be an indication of the transformer boost. It is important to know if the voltage is tapped up and the extent, to be sure of data obtained from the graphs.

Frequently the three-point voltage switch is used to obtain the voltages and balance of voltages on three-phase primary or secondary circuits. Differences between the values can be depended upon to be reasonably correct. Changes in the relation of the differences is due to loads of



THREE-POINT current-transfer switch for three related currents



TYPICAL ammeter chart of currents in the legs of a three-phase circuit

Arrangement of the three-point current transfer switch is shown at left. Its applications include (1) determining load balance on industrial banks and (2) the determination loading of each transformer in a bank when single-phase or half-voltage, three-phase loads are supplied from the mid-point of the secondary in addition to the full-voltage three-phase load.

The transfer switch used is similar to the voltage switch except that contacts normally short circuit the current transformer secondaries and open the contacts for the time each phase graph is being recorded.

The current chart illustrated shows graphs of current in each phase of a primary circuit which indicates the circuit that should have load balanced.

Chart Speed

Many of the charts so far obtained were made with a speed of 3 in. per hour. It will be practical to reduce the speed on the instruments concerned. We expect to do this to a considerable extent when it is possible to obtain the necessary meter chart change gears.

uneven values and character not being uniformly sustained. In addition to indicating the general voltage level on each phase, this chart helps in checking load balance between phases and is a guide to the amount of load that must be transferred from the heavy-loaded (shown by low voltage) to the light-loaded phase to bring about balance.

The three-point switch also is used to obtain the three phase-to-neutral voltages at a service supplied by a four-wire network.

Four-Point Voltage Switch

Application of the four-point voltage switch to: (1) three-phase, four-wire, (2) single-phase, three-wire and (3) terminals of two adjacent three-wire circuits appears in one diagram.

For instance, chart of four traces of secondary voltage obtained on each side of the terminals of two adjacent three-wire secondary circuits shows that:

(a) Division of secondary load on the two adjacent circuits is not made at the proper location if the transformer size, spacing and secondary wire size are to remain unchanged.

(b) Voltage from either secondary is not adequate to supply 120-volt utilization equipment. Secondary may need to be redesigned. Possibly additional data should be obtained showing how primary voltage is sustained.

The four-point switch has been used to obtain the voltage on the terminal of each phase of two adjoining primary circuits. The test is made by allocating three points of the switch to one circuit and one point to "A" phase of the second for the first 24 hours. Then contacts on "B" and "C" of the first circuit are transferred to the corresponding phases of the second circuit for 24 hours. This yields a graphic record for each phase of each circuit and a pilot graph on phase "A" of each circuit covering the total time of both tests. Any change of voltage levels during the test will be revealed by the trace of phase "A." The above tests will normally indicate whether the division point allocates the load to the two circuits to the best advantage.

Store Oil in Old Transformer Tanks

Storage of transformer oil removed from substation transformers in the field during maintenance and repair operations is a minor but irritating problem these days. Formerly it was customary to round up a number of 55-gal. oil drums from a convenient bulk oil station and use them to store the oil temporarily during repair operations. But now oil drums are frozen by government order.

Illinois-Iowa Power Company, Decatur, has met the problem by converting old water-cooled transformer tanks into emergency oil storage tanks at several of its substations. The old tanks are stripped of all salvagable metal, such as heavy cast-iron covers, nameplates, etc. The inside is coated with glyptal varnish, the outside painted and a galvanized sheet metal cover used to replace the salvaged cast-iron one. Set up at a convenient place in the substation, they are a highly useful and not unharmonious addition.

Blackout Problems of a Utility Serving 16 Counties*

Movement of men and vehicles — Uniform phrasing of warning messages — Manning of warning and recovery control centers — Policy for turning out street lights

W. R. HAMILTON,† West Penn Power Company

THE power companies in their problems in relation to blackouts fall into two general groups: First, those companies which serve principally metropolitan areas having a high density of population; second, those companies whose systems are more widely spread and whose main population centers are principally third-class cities and smaller communities scattered among many counties.

To West Penn Power, as typical of a company with a widespread system, the subject of blackout has six principal aspects. These are:

First—Warning system.
Second—Manning of property.
Third—Turning out of lights.
Fourth—Handling of the load drop and pick-up.
Fifth—Operation during an actual air raid.
Sixth—Moving men and cars during an air raid.

The West Penn System covers an area of 8,770 square miles, spread over sixteen counties. Each of these counties has its own O.C.D. organization and the communities receive their air raid warnings from sixteen different warning centers.

Lack of Uniformity in Messages

When an air raid warning is received we make sure that it is authentic before we accept it and we ascertain whether the warning is for a test or for a real air raid. Utilities have a responsibility not to black out on false alarms. There are many problems in adjusting load and manning stations taken in a real air raid that are not taken in a drill.

Phrasing of the warning messages can be improved greatly. Many of them are too long. Some do not even identify the source. Some counties use special code words, but many telephonists do not follow the codes and the word "test" is too often omitted. This all adds to the difficulty in training our men how to check for authentic messages and whether the warning is real or a test.

During a real air raid we consider it would be necessary to start employees to man the entire property on the "yellow" in order to have all property protected before the "red." These employees would move even in those communities whose warning district had not yet flashed the "yellow" because we would have no assurance that a "yellow," "blue" and "red" would not come elsewhere in quick succession. On the other hand, if the alarms are only on a test, we obviously will move men only in the territory covered by the test.

Area Variations

The areas to be alerted from each warning center approximate the counties in Pennsylvania, with the warning center being in the county seat. However, these vary from county and state boundaries to meet geographical conditions, and particularly so to keep all of any built-up districts within one warning area. It was intended that these areas work as a unit during air raid drills, but most counties have been insisting that all of the county participate in so-called county drills. We have no way of knowing beforehand that only one county will take part in any drill and that the area involved will be any different than that set up for actual conditions. It is only after valuable time is lost and after not receiving similar alerts from other warning districts that our dispatchers learn that only one county is participating.

Warning Communities

Sometimes a district warning center on a county test by mistake flashes the alert to communities not in the county, but which are on the list to be warned all other times, or forgets to include communities in their county not on their warning list. Because these practices are not consistent, our dispatchers have difficulty in directing the company's part in these tests. Many of our men must begin moving on the first warning, sometimes from one town to another, and often from one county to another.

We are developing the plan of warning communities when it is apparent they have failed to receive the warning over the regular channels.

Several of our street light circuits in built-up areas cross municipal and county lines, and to turn out the lights for such blackouts would cut out lights in towns not taking part in the test. Bridge lights are often controlled from the side of the river not taking part in the test. Several communities near county lines have been confused when they heard the air raid sirens blowing in nearby communi-

* Adapted from a recent paper before a joint engineering meeting in Pittsburgh.
† Superintendent of system operation.

ties across the county lines and other communities in their own county did not black out. This is especially true if one community depends on the sirens of another community across the county line.

Manning the System

Most of our automatic substations are either normally non-attended or attended by a residential operator. It has been our practice to have an operator on duty at the more important non-attendant stations and a second operator on duty at the attendant stations during very bad lightning, sleet and wind storms. An actual air raid should justify these same precautions; thus about fifty emergency operators have to be called out.

During a real air raid fire watchers have to be called out to man the roofs at many stations, offices, garages and storerooms. At the large garages the line and service trucks should be moved out and dispersed along adjacent streets so that one bomb will not destroy all of our fleet in that area.

Our five regular dispatching centers for line crews each covers all the towns in several counties, but they are open only fifteen hours a day. At the time of an air raid these division centers have to be manned if they are closed. We plan to establish a dispatching center in every community of any size in order to take trouble calls from the community control centers.

Linemen and electricians will not move unless they are assigned as guards or extra operators or are called out for emergency repairs. These men will not be mobilized at any centers, but will stand by at home. Neither will dispatching organizations be increased above that necessary to carry on efficiently. Thus, if bombs drop on any of these centers, we have reserves in the area to carry on.

On past tests we have had all men at their locations within twenty minutes. It is only if unforeseen delays or accidents occur or the "red" comes with very little warning that any of these men will have to use their authority to travel during an actual air raid blackout to reach their destinations.

The problem of arranging for employees to move from their homes to stations, garages, storerooms and trouble centers before an air raid is a difficult one. For every man who should move, we must provide about three alternates, for no one person can be expected to be home all the time. Frequently, the first, second or even third alternate has to be called, although the men should report off when away.

This mobilization of our employees requires our men on duty over the system to make about 250 calls as soon as they receive the first air raid alert and it has been confirmed by the dispatcher. Calls are spread over sixteen counties. No one operator will have more than ten calls to make unless he has to call several alternates. We pass no calls to employees who do not have an assignment and our employees are not to call each other, their relatives or us, unless the calls are what we call "Public Utility Emergency."

Some employees who are expected to be on call during air raids will not receive the preliminary signals. If they are not home when a blackout starts we expect them to call their headquarters and report where they can be reached. They are not to use their arm bands to move about during an air raid unless we call them. As such calls come after the sirens have blown, they occur when the telephone traffic is abnormally low.

The moving of employees to their assignments in time before the "red" will be difficult if the wardens and auxiliary police hinder their moving. There have been numerous cases of wardens stopping traffic before the "red" warning had been received.

Street Lights

Our policies about turning out street lights and our station protective lighting follow one approved plan for the entire system. Several communities wanted all street lights turned out on the "blue" signal, while others insisted that it be only on the "red." Some communities insisted that the street lights not go out until the local warden ordered or the local sirens were heard. Others wanted them out as soon as we received the signal from any source.

The air raid regulations state that the "yellow" and "blue" signals are confidential. We cannot turn out lights on the "blue" and still keep the "blue" warning confidential. It is our responsibility to get all lights out as quickly as possible once we know the blackout is the real thing and just what area it covers. Many communities depend on the street lights going out as a signal that an air raid blackout is in progress—especially where sirens cannot be heard. New York state has since ordered sounding siren on both blue and yellow.

Repairing Damage

Falling bombs will cause some damage which will have to be repaired promptly and crews will have to move to make these repairs, but these crews will not move unless ordered by the control center. In each control center there is to be one person who represents or is responsible for the utilities. This person need not be a trained utility employee, for he will simply report to the dispatching center each utility has or will set up the bomb incidents to be covered, and we will dispatch our own crews.

It is not probable that utilities would move crews during an actual air raid to repair any bomb damage unless the damage causes a serious fire, affects war industries, or interrupts service to critical locations such as hospitals or water pumping for fire fighting. We might move isolated men to sectionalize lines. Then we might move men to cut into the clear wires that are down along or over important highways or railroads or which span navigable rivers.

Wardens and auxiliary police have not had much experience in the regulation of cars and trucks which are authorized to move. Improvement is needed or few emergencies will be handled during and following any real air raid.

Problems Still Unsolved

The problem of assuring emergency cars the right to travel without hindrance during air raids is, in my opinion, one of the most important problems still unsolved. Other problems needing attention are the phrasing of the warning messages, training the telephonists on the transmitting of the messages, proper manning of the warning centers, elimination of the confusion on county tests by failing to follow warning districts and the organization and manning of control centers.

Conservation of Materials in Substation Design

Structural steel more than halved by resort to wood members reinforced by standard line hardware supplements — Costs are also pared in a wide range of substation structures

E. M. ADKINS, Electrical Engineer, Jersey Central Power & Light Company, Asbury Park*

USE OF STEEL for the construction of substation structures has certain obvious advantages, the principal one being its higher mechanical strength. Use of steel, on the other hand, has one obvious disadvantage which is not present in wood structures. This is the gradual deterioration of the protective coating provided by galvanizing. In order to protect against the rapid destruction of the structure by rust, in some localities it is necessary to paint the structure at regular intervals. This is a not inconsiderable maintenance expense which is not necessary with wood structures.

In the use of wood structures the design should be standardized as far as possible and should be carefully planned to conserve in space, thus conserving materials. Better results can possibly be secured if previous ideas of steel structure design and layout are forgotten and a new start is made and developed for wood structures.

The wood to be used should be carefully selected from a select grade of structural timbers. Douglas fir or Southern yellow pine will in general give good results. In those localities where wood is subject to deterioration and decay it should be finished and drilled for assembly and then treated with creosote or other suitable protective agent. If the best grade of lumber is selected and the preservative treatment is carefully applied a wood structure should be conservatively estimated to have a life of 20–25 years.

We have found that 4x6-in. timber, using standard stock supplies of wood poles for columns, will in general give satisfactory results. For the larger structures, requiring longer spans, larger timbers such as 6x8-in. or 8x 10-in. will be required. In most cases it will also be found desirable to use cut timbers for the column uprights in the larger stations. The expense will be greater as compared with the use of wood poles, however. Considerable strength, if needed, can be added to the structure by the use of a relatively small quantity of struc-

*Adaptation of recent paper before power group of New York A.I.E.E. section.

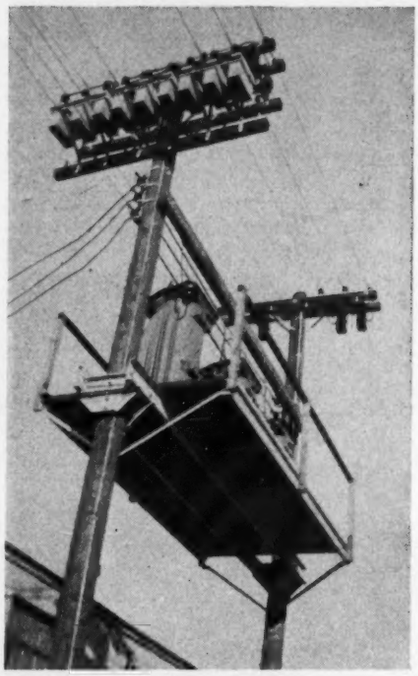


FIG. 1—Pre-priority platform with 12½-ft. spacing

Required 725 lb. of structural channels and angles along with 224 board-feet of planking and railing. Total material cost, exclusive of electrical equipment, $70 to $115.

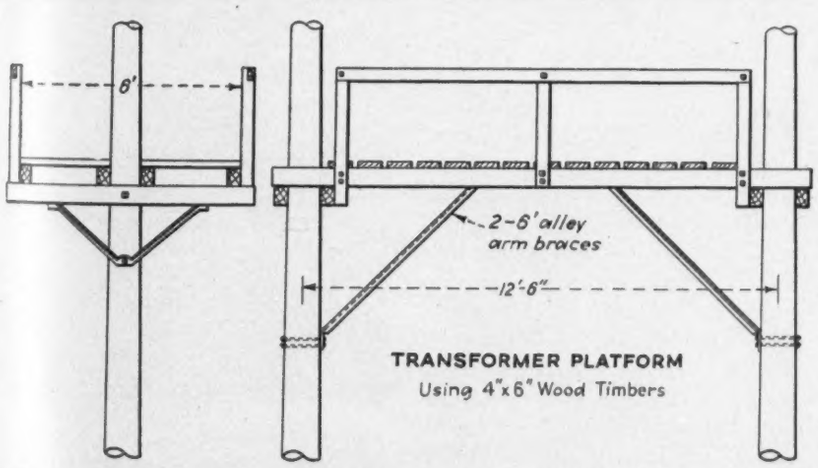


FIG. 2—Platform of Fig. 1 redesigned to use 4x6-in. timbers and two 6-ft. alley-arm braces requires only 275 lb. of steel (including bolts, nuts and washers). 30 timbers totaling 350 board-feet. Material cost $50-$80. Safe for three 1,800-lb. transformers

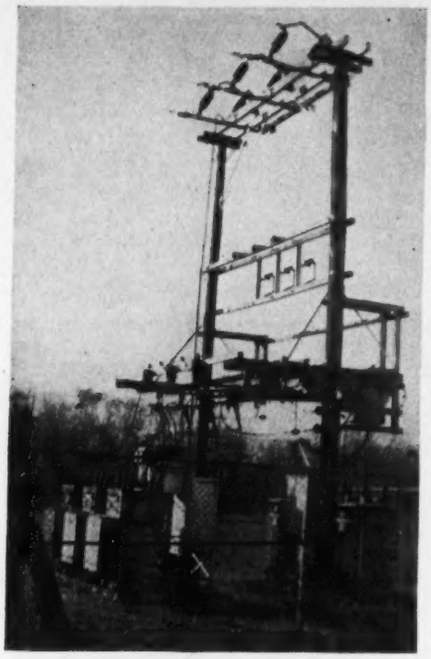


FIG. 3—Two-pole 14-ft. structure for general distribution service

Takes only 185 lb. of steel in pole-line hardware and machine bolts, 118 lb. of copper for buses, equipment leads, etc.; 230 lb. of copper and steel in protective grounding system, two 40-ft. poles and 28 4x6-in. timbers (540 board-feet). Cost of structure $160 (poles, wood timbers and hardware). Capacity is one distribution feeder with full protective and regulating equipment; serves 34 miles of 2,400/4,160-volt rural circuit.

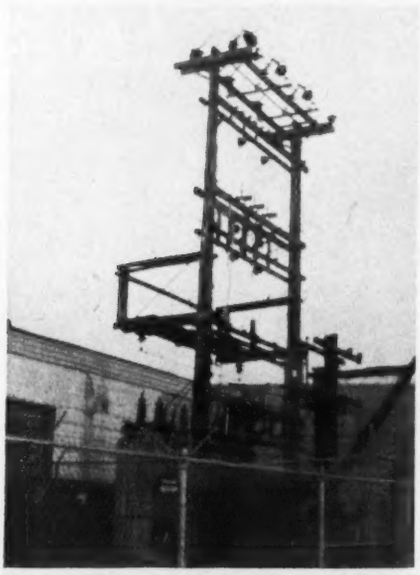


FIG. 6—Station for small and medium industrial loads has two poles at 13 ft.

Requires 240 lb. of steel pole-line hardware, bolts, nuts, etc.; 110 lb. of copper for bus and equipment leads, 140 lb. of both for grounding and 36 timbers (4x5 in.) totaling 512 board-feet. Cost $165. Station has three 500-kva., 34/2.4-kv. and three 150-kva., 2,400/240-volt transformers. Can supply one feeder with protective and regualting equipment or two feeders without.

tural steel used for bracing. The strength of structural steel is consistent and uniform. This is not the case with wood and is one of its disadvantages when used for structural purposes. The strength of wood timbers of the same kind and grade will vary widely. This disadvantage requires that a high factor of safety be used.

In many cases the steel used in the structure can be confined to standard pole-line hardware such as angle crossarm braces, alley-arm braces, machine bolts, etc. The use of such material will produce a structure of good mechanical strength and rigidity. Another of the disadvantages of a wood structure is that the timbers sometimes warp. This tendency can be overcome to a considerable extent by careful selection, using timbers of a sufficient cross-section with respect to their length and the liberal use of machine bolts, double arming bolts and wood-pole line hardware to increase the rigidity.

Design for Appearance

A frequent objection to the use of wood structure substations in the past has been their looks or appearance. Steel structures have, in fact, generally made a better appearance than the wood structures with which they are compared. This is mainly a fault of design. In general, more care was exercised in the design of the steel structure and consequently a better looking structure resulted. The wood structure was regarded as a makeshift or temporary job and little attention was given to its design. Wood structures now necessitated will be with us for a long time and therefore call for best design talent.

Impulse Strength

Use of wood adds materially to the impulse strength of the station. We have had one very unhappy experience with a wood-structure station. The station was to serve an industrial customer and was built in a location where equipment was subjected to heavy deposits of powdery dust and intermittent discharges of sulphuric acid vapor, along with heavy fog. The dust was non-conducting and we thought that frequent cleaning and over-insulation would overcome the difficulty. However, the dust and acid vapor were much worse than was anticipated and the dust

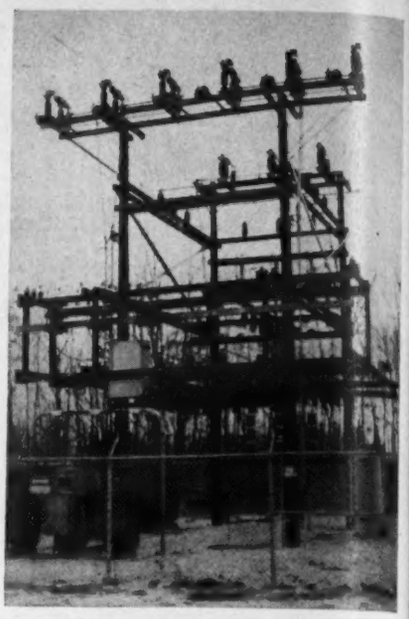


FIG. 4—Constructed before the war emergency, this station is supported on four poles at 13x20-ft. spacing

Requires 715 lb. of standard pole-line hardware, 1,850 lb. of structural steel (due to long spans), 585 lb. of copper tubing and wire (slotted steel pipe could now be substituted), 590 lb. of copper and steel in protective grounding system, four 40-ft. poles and 72 4x6-in. timbers totaling 2,150 board-feet. Cost of hardware, structural steel and wood, $850. Capacity is four 2,400/4,160-volt feeders; serves 60 miles of rural circuit through three transformers, one spare with provision for quick substitution. Recent all-steel station of equivalent feeder capacity used 25,000 lb. of steel at a cost of $2,100.

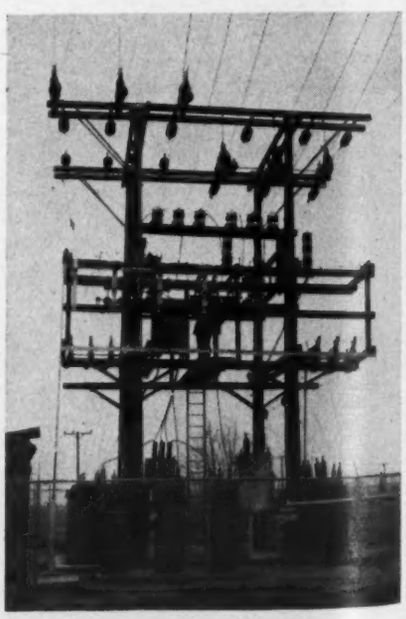


FIG. 5—Similar to Fig. 4 but providing two banks of transformers (without spares) as inter-utility tie at 26/12 kv.; supplies 55 miles of rural and military load, towns and industry

acted as a fine carrier for the acid.

The station was put in service in December and several transformer bushings flashed over to ground in March. A roof was then built over that part of the station. A bushing of the high-voltage metering transformer next flashed over to ground in June and repeated in August. The portion of the structure on which the incoming air-break switch and downleads to the metering set and bus was mounted could not very well be roofed over and in this exposed portion a phase-to-phase flash between horizontally mounted bus supports occurred in October.

The fact that the structure was of wood apparently, also, added materially to the 60-cycle insulation strength in this case.

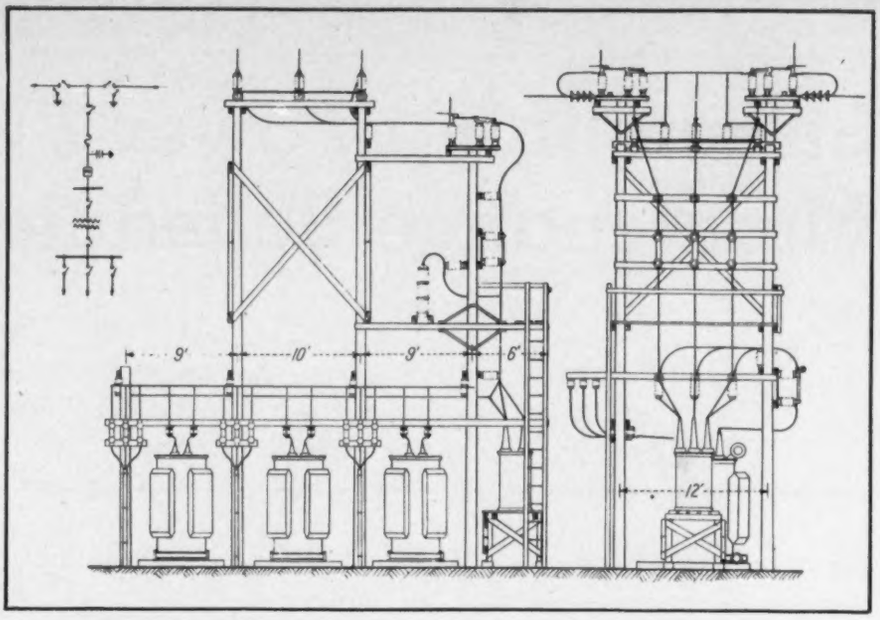


FIG. 7—For medium and large power loads

This 12x28½-ft. station is designed to require only 460 lb. of steel pole-line hardware, 750 lb. of slotted steel bus and conductors, 500 lb. of grounding copper and steel, 100 lb. of copper for low-voltage leads, six poles and 84 4x6-in. timbers totaling 1,750 board-feet. Cost $500. Low-voltage bus suitable for three 1,250-kva. transformers at 2,400 volts. Provision for individual switching of transformers and line loops.

Savings in Conductors

Other scarce materials, essential in substation structures, for which substitutes must be found are copper and aluminum for bus work. As was noted in Stanley C. Killian's article "Evaluate Steel Pipe as A.C. Conductor," ELECTRICAL WORLD, April 18, 1942, steel pipe can sometimes be satisfactorily substituted for copper tubing. In many cases in the past the size of copper tubing required for bus work was determined by mechanical strength necessary to avoid excessive deflection. Galvanized steel pipe has much higher mechanical strength and a smaller size can, therefore, be used for bus extensions where mechanical strength is the controlling factor. The alternating-current-carrying capacity of steel pipe is much lower, however, than copper tubing. The current-carrying capacity of steel pipe can be appreciably increased by introducing an air gap into the magnetic flux path by providing a slot throughout the length of the iron pipe. Such steel pipe will in general be found to have an adequate current-carrying capacity for use as a high-voltage bus so that the substitution of steel pipe for copper tubing can be made satisfactorily.

At the lower voltages the current density is much higher and the substitution of iron pipe for copper tubing is not so easily made. It was noted in Mr. Killian's article on the use of steel pipe as an a.c. conductor that the current-carrying capacity of the larger size of steel pipe was not proportionately greater than the smaller sizes. For instance, a ¾-in. slotted steel pipe was found to have a current-carrying capacity of 215 amp. with a 30 deg. C. rise in temperature, while a 3-in. slotted steel pipe was found to have a current-carrying capacity of only 440 amp. However, if multiple conductor clamps are used a satisfactory substitution of steel for copper in the lower voltages for bus work can often be made. For instance, the use of three ¾-in. slotted steel pipes will have an a.c. current-carrying capacity reasonably close to the current-carrying capacity of a ¾-in. copper pipe. As the current increases, however, this substitution is progressively more difficult to make.

The illustrations record specific quantitative savings effected by application of the above principles.

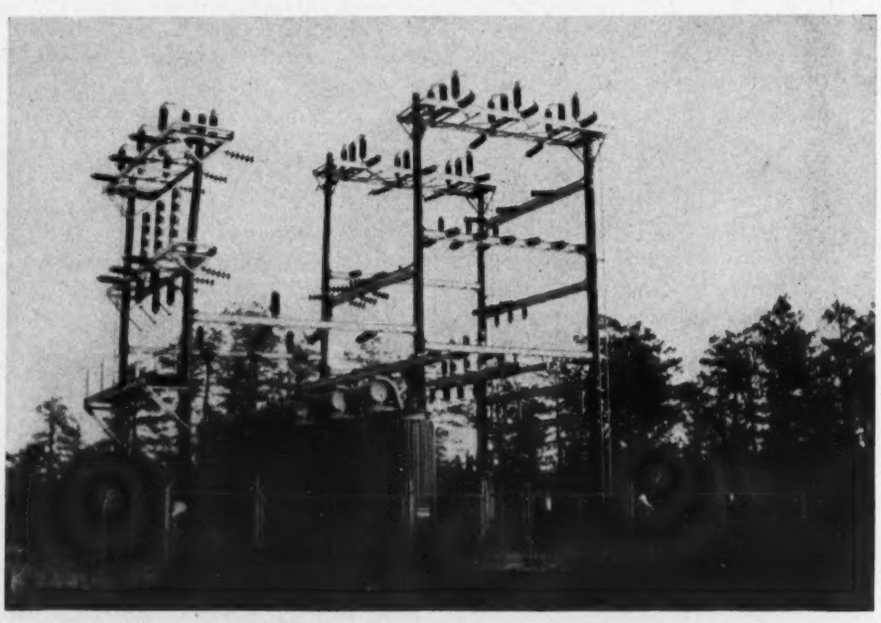


FIG. 8—Transmission type station as built uses wood poles and cross-members of steel; wood could be used for cross-members by using shorter spans and appropriate bracing. Two 5,000-kva. transformer banks are installed as a 69/34½-kv. tie

Streamlining Power Plant Maintenance Schedules

Equipment inspection routines established on time basis to forestall service interruption — "Paper" work simplified by complete program

SERVICE CONTINUITY and production economy in a regularly operated generating station depend vitally upon adequate maintenance. Systematic inspection methods are essential to these objectives. War service demands upon public utility power plants increase the importance of keeping all available units and auxiliaries in readiness to supply needed capacity even where some efficiency is sacrificed in supplying these imperative loads. Properly scheduled maintenance is therefore of supreme importance to peak load, standby and reserve equipment as to base load apparatus.

A comprehensive system of power plant inspection and maintenance has been developed over a period of years by Stone & Webster Engineering Corporation, Boston, for use by utilities under Stone & Webster supervision. It is simple in principle and, while far too extensive in detail to be reproduced fully here, requires but a minimum of clerical work once the program is set up for a particular utility plant. This is of great advantage from the operating standpoint, since the establishment of an inspection schedule (embracing all important apparatus units and parts) codes the procedure until experience or modifications of the plant require future changes in the routine. It is only necessary thereafter to follow through the schedule as prepared in advance for each week of the year from 1 to 52 inclusive for the inspection of specified units. Coverage is thus insured and nothing is left to chance or to memory.

The Stone & Webster system was modified some years ago in the interest of "streamlining" the job and simplifying the paper work involved. The principal change consisted of scheduling the inspections by weeks instead of by days as formerly. The revised system eliminates the need for preparing daily work orders for the maintenance crew. Further, as a week is now allowed for each group of inspections, more latitude is permitted in planning the maintenance work, with the result that there is less possibility of some inspection tasks remaining uncompleted at the close of the week in which they are scheduled. A card file formerly used, on which the inspections were listed by days, was replaced by a master loose-leaf book of encyclopedic dimensions designed to fit the layout and equipment of the generating plant concerned and listing all apparatus, inspection periods and maintenance routines in minute detail.

EQUIPMENT INDEX

Equipment	Symbol	Week of Year for Main Inspections
Regulators	R	10
Reactance Coils	RC	4
Relays	Rel	12
Roof	Rf	6
Radiators and Heating Coils	RHC	26
Rheostats	Rhs	8
Reactor Ventilating Fan	RVF	11
Reactor Ventilating Fan Motor	RVFM	19
Resistors	Res	8
Stoker No. 10	10 S	6
Screen Well Motor	SCRM	51
Screen Well Pump	SCRP	45
Shafting	Sh	1
Shutters	Shu	17
Signal System	Sigs	12
Station Light and Power Switch	SLPSw	8
Stoker Motor No. 10	10 SM	31
Solway Control	Sol SW	6
Stairs	St	13
Station Transformers	STr	12
Switches	Sw	12
Sump Well Motor No. 3	3 SWM	1
Sump Well Motor No. 4	4 SWM	46
Sump Well Motor No. 5	5 SWM	43
Sump Well Pump No. 3	3 SWP	1
Sump Well Pump No. 4	4 SWP	46
Sump Well Pump No. 5	5 SWP	9
Spare Parts	SP	12
Starters	Sta	12
Turbine No. 3	3 T	7
Turbine No. 4	4 T	28
Turbine No. 5	5 T	10
Tanks	Ta	1
Total Arc Switch	TASw	3
Transformer Bank No.1, 13/2.3-kv.Switch 1	TBSw	45
Transformer Bank No.2, 13/2.3-kv.Switch 2	TBSw	46

TYPICAL equipment index sheet, with symbols of apparatus and week of year in which annual inspection is scheduled to take place

CATALOG OF INSPECTIONS

Turbine No. 3 (Section II) — Symbol — 3T

Annual	Semi-annual	Quarterly	Monthly
4-8-18-19	8-18-34-40-41	126-132-153	126-193
34-40-41-46	46-50-57-62	166-183-190	
50-57-58-62	66-78-79-87	193	
63-64-66-78	95-104-110-114		
79-84-87-94	126-128-132		
95-104-110	147-153-158		
114-118-126	162-166-170		
128-132-134	183-185-190		
147-153-158	193-240-247		
162-166-170			
183-185-190			
192-193-240			

TYPICAL sheet from catalog of inspections, showing numbered inspection jobs due to be performed on turbine No. 3 annually, semi-annually, quarterly and monthly

Elements of the System

Work orders applying to equipment units and based upon these prescribed weekly routines are issued at the plant by the chief engineer or whoever is responsible for maintenance supervision to the power plant crew. Upon completion of the job, of which there are many hundreds in a year, these forms are filled in by the maintenance supervisor or foreman and constitute reports of inspections made and maintenance work performed upon each piece of apparatus. From these field sheets permanent records are then prepared for filing under equipment units, thus covering the complete inspection and maintenance history of each equipment item over the years of its service in the plant. Aside from showing that inspection and maintenance work have

been done to prevent failures and insure maximum availability, such records are of great analytical value from the operating and engineering standpoints.

It is believed that the flexibility of the present system enables it to be readily adapted to stations having rather wide variations in operating schedules from year to year. The object of the program is in large measure to avoid the necessity of taking equipment out of service during peak loads or at times when it is needed to meet other operating requirements. By proper scheduling it is generally possible to make all repairs in an orderly manner during the usual working hours and not in a rush or perhaps on an overtime basis as when repairs are delayed until a forced shutdown has occurred. The regular inspections called for by the maintenance schedule are designed to insure the detection of defects or deterioration before serious trouble has developed. While the frequency of such inspections is planned to be such as to prevent breakdowns, care has been exercised to avoid needless or too frequent inspections.

INSPECTIONS FOR WEEK NO. 6

Section	Annual	Semi-Annual	Quarterly	Monthly
I				
II		3 FOT	4 EXT	4 T - 4 CT - 5 FPT 4 BT
III		3 FOP		1 FOP
IV			4 BFP	4 CP - 4 AP - 1 Syn. COP 3 SWP - 2 Syn. COP
V				4 C
VI	10 S			1 B - 11 B
VII	CHE - 5 PH			R - GC
VIII				
IX	HCPW		4 EX-4 XM	4 G
X	BAT-Sol.Sw.			
XI	RF			

Key to above symbols:

FOT - Fuel Oil Pump, Turbine	C - Condenser
EXT - Exciter Turbine	S - Stoker
T - Turbine	B - Boiler
CT - Condenser, Turbine	CHE - Coal and Ash Handling Eqpt.
FPT - Priming Pump Turbine	PH - Primary Heater
FOP - Fuel Oil Pump	R - Regulator
BT - Blower Turbine	GC - Drive Chain
BFP - Boiler Feed Pump	HCPW - Primary Heater Condensate Pump
CP - Condenser Pump	Stoker
AP - Air Pump	EX - Exciter
SWP - Sump Well Pump	XM - Exciter Motor
Sol.Sw - Solexy Switch	G - Generator
Syn.COP - Synchronous Condenser Oil Pump	BAT - Battery RF - Roof

INSPECTIONS FOR WEEK NO. 46

Section	Annual	Semi-Annual	Quarterly	Monthly
I				3 AC
II			3 T	
III				2 FOP
IV	4 SWP		5 HCP	5 CP — 5 AP
V			10 S	17 B, 3 B, 5 B, 6 B
VI				
VII			CHE	
VIII			Ga	
IX	4 SWM		3 G	4 CM
X	13kv/2300-v. 2T RBM		Co	Inst.

Key to above symbols:

3 T - No. 3 Turbine	FOP - Fuel Oil Pump
3 AC - Air Compressor No. 3	SWP - Sump Well Pump
HCP - Heater Condensate Pump	5 CP - No. 5 Condenser Pump
5 AP - No. 5 Air Pump	10 S - No. 10 Stoker
3 B - Boiler No. 3	CHE - Coal Handling Equipment
5 B - Boiler No. 5	Ga - Gauges
6 B - Boiler No. 6	4 SWM - No. 4 Sump Well Pump Motor
17 B - Boiler No. 17	4 CM - No. 4 Circulating Pump Motor
Co - Controller	Inst. - Instruments
2 TRSw - No. 2 Transformer Bus Switch	

INSPECTIONS required in 6th week of year and in 46th week

In making up the schedule, items of operation have been excluded such as routine oiling, examination of equipment for signs of overheating and the usual operating adjustments. The schedule is planned so that the inspections are carried out through the year without too much work occurring in any one month. It shows the operating personnel when each of the units is to be taken out of service for overhaul. By indicating the group of inspections due to be made each week of the year, the work can be planned to make the best use of the time of the maintenance forces.

Inspection and Maintenance Details

The numbered lists here are of items on typical inspection and maintenance job sheets in twelve major plant and equipment classifications. Sheets of this character, which amount to many hundreds in the complete listing of inspection and maintenance jobs in a given power plant, specify work to be done on each piece of equipment

I. RECIPROCATING ENGINES

40—CRANK—Case—examination and cleaning of—noting condition of splash lubricating system, stopping all leaks; high-pressure and low-pressure sides.

44—CRANK—Disc—cleaning and examination of—for solidity and tightness on shaft; high-pressure side.

45—CRANK—Same as 44, except for low-pressure side.

50—CRANK—Pin—examination of—for wear, scoring and lubrication. Noting security in crank, cleaning oil holes, calipering and recording maximum and minimum diameters; high-pressure side.

51—CRANK—Same as 50, except for low-pressure side.

56—CRANK—Shaft—cleaning and examination of—for flaws, scoring, heating and distortion.

60—CRANK—Weights, balance—examination of—for security of fastening.

66—CROSSHEAD—Guides—checking alignment of—readjusting as required; high-pressure side.

67—CROSSHEAD—Same as 66, except for low-pressure side.

II. STEAM TURBINES

56—BEARINGS — All horizontal—Thrust—Superficial examination of—when bearing cap is off. Measurement of end play.

58—BEARINGS—Horizontal Curtis only—Thrust—examination of—complete dismantling. Checking running clearance. Cleaning all thrust rings and rollers, measuring wear.

60—BEARINGS—Thrust—examination of—checking running clearance, noting condition of oil grooving and security of babbitt facing.

62—BEARINGS — All horizontal—Thrust setting—examination of—recording upper and lower setting as found and as left.

70—BLADING—Examination of—stator and rotor for axial and radial rubbing, erosion, cleanliness and security, general condition.

80—CASING—Opening of.

90—CLEARANCE—Vertical only—Axial—Measurement and recording while hot—steam and exhaust sides. All stages. Immediately after shutting down. Readjusting as required.

92—CLEARANCE—Auxiliary only—Axial—Adjustment of—to give the buckets the exact amount of lap (beyond edge of steam nozzles) specified by manufacturer. Check and record clearances before removing rotor.

94—CLEARANCE—Axial and Radial—measurement of—readjusting as required.

96—CLEARANCE—Horizontal only—Axial—measurement and adjustment of—recording (first) distance spindle is moved toward H.P. end to obtain touch of blading; (second) distance spindle is moved from H.P. touch position toward L.P. end to obtain slight touch; (third) position in which spindle is left.

III. RECIPROCATING PUMPS

24—GAGE GLASSES—examination of—and cleaning.

30—LUBRICATORS — Mechanical — examination, cleaning and overhauling of—and connected piping.

40—PACKING — Plunger—examination of — noting condition. Adjustment or renewing as required. Recording kind and trade name of material used.

44—PACKING—Rod and Stem, Steam—examination and adjustment of—renewing as required, Recording kind and trade name of material used.

48—PACKING—Rod, water or oil—details as in 44.

52—PACKING—Sheet—examination of—renewal as required of all joints using sheet packing gaskets. Recording kind and trade name of material used.

IV. CENTRIFUGAL PUMPS

No. 4 Boiler Feed Pump (B.V.G.&E.Co.)

4—ALIGNMENT—Checking of—with driving unit.

8—BEARINGS—Guide—examination of—for signs of scoring and heating. Note condition of thrust surfaces.

12—BEARINGS — Journal — examination of — for signs of scoring and heating. Note condition of oil rings.

16—BEARINGS—Shell—examination of—for signs of scoring, heating and undue wear. Cleaning oil grooves and cooling water jackets.

20—BEARINGS — Thrust — examination of — for signs of scoring, heating and undue wear. Noting end play and adjusting as required. Cleaning oil grooves and cooling water jackets.

24—BUSHING RINGS—Impeller—cleaning and examining of—for wear and security.

28—CASING—Internal examination and cleaning of—noting pitting and corrosion.

32—CASING—Testing of—joints on suction side for air leaks.

36—COUPLING—Examination of—bolts, bushings, rubber buffers, flanges, set screws, keys.

40—FOUNDATION BOLTS—Tightening of.

44—IMPELLERS—Cleaning and examination of—noting incrustation, erosion, security on shaft.

50—OIL—Chambers—cleaning of—and renewal of oil when required.

60—PACKING—Shaft—examination of—renewing of required. Paying special attention to position of water seal cages.

70—SHAFT—Examination of—for alignment and signs of wear in way of packing and bearings.

80—VANES—Diffusion—cleaning and examination of—noting pitting, incrustation and erosion.

[See next page]

TYPICAL maintenance work order and report and typical page from permanent record file folder sheet in history of sump well pump No. 5, from April 15, 1941, to November 17, 1942

MAINTENANCE WORK ORDER AND REPORT

SO FORM A 4301-11

DATE July 24, 1942

TO A.Klaeson #1

Please make the following inspection called for by the maintenance schedule, and report in full the results of your work.

No.4 Boiler Feed Pump (500 GPM)

4-Alignment-checking of, found coupling half on pump running 0.022 out of round with dial indicator due to shaft in pump slightly bent. Coupling half on motor end running 0.003 out of round. Lined up coupling halves best as possible due to conditions.

12-Bearings-Journal- In good condition.

20-Bearings-thrust-In good condition. end play 0.014

28 Casing-Internal examination of. In good condition

36-Coupling. Bolts and bushings in good condition

40- Foundation bolts. Tight.

REPORT { Describe the nature of repairs made; record quantity and kind of materials used, parts renewed, important dimensions and all information which may be valuable for future reference.

44-Impellers. In good condition, bored out inside of hubs of impellers to 2.518 in.

50-Oil chambers- Washed out and renewed oil.

60-Packing-Shaft--Renewed packing, 1/2 in.----- Make, 5 rings on thrust end, 7 rings on coupling end

70-Shaft-found shaft badly pitted. Machined and sprayed with ----- 11 gage B.& S., and machined shaft to size, 2.518 in way of hubs on impellers and shaft spacer bushings

16-Bearings-Shell. In good condition

44-Bushing Rings-Impeller-Rings machined with----- and to size. Sketch shows diameters of impellers in way of wearing rings as found and left. Sleeves on shaft in good condition.

APPROVED FOR ENTRY ----- CHIEF ENGINEER

Use other side of this sheet if necessary

No 5 SUMP WELL PUMP

4-15-41 4 Alignment with driving unit is correct.
V.D.L. 12 Made bushing for journal bearing which was badly worn on outside dia & working loose from anchor set screw.
20 Thrust bearing shows sign of wear and will need next annual inspection.
24 Impeller is in good condition.
28 Examined casing internally and found it in bad shape, the cast iron is very thin and turning into graphite. Braced the outside of casing on the flat side and around the bearing bore & strengthen them would suggest a new one as soon as possible.
32 Tested joints on suction side and found in good condition.
36 Examined Couplings- bolts- keys - rubber buffers and flanges, found all in good condition.
40 Foundation bolts. tight.
50 Cleaned old grease out and filled with new.
70 Impeller shaft in good condition
9-5-41 4 Checked alignment with driving unit found correct.
8- Examined guide bearings. found in good condition.
20- Examined thrust bearing, found ball bearings pitted a little, otherwise in good condition.
24- Impeller - secure, in good condition
28- Casing - has been repaired considerably and need replacing with next one.
36- Coupling - examined, bolts- bushings - rubber buffers - set screws - keys, found in good condition.
40- Foundation bolts- tightened
50- Cleaned out old grease, replaced with new.
70- Shaft- In good condition
8-10-41 Cleaned out #5 Sump well and flow drains

To illustrate the major features of this system when applied to a specifie public utility plant, the Pawtucket (R.I.) steam station No. 1 of the Blackstone Valley Gas & Electric Company has been selected. What follows is not a complete presentation of the inspection requirements of this plant, but an outline of the program from which the reader can make up a similar schedule for his own plants according to the operating conditions there prevailing. Only samples of the Pawtucket set-up can be presented in this article, but these constitute a fair cross-section of the system.

The equipment inspection system is divided into thirteen major headings: (I) Reciprocating Engines; (II) Steam Turbines, (III) Reciprocating Pumps, (IV) Centrifugal Pumps, (V) Condensers, (VI) Steam Generating Equipment, (VII) Miscellaneous Mechanical Equipment, (VIII) Mechanical Measuring Devices, (IX) Rotating Electrical Machinery, (X) Miscellaneous Electrical Equipment, (XI) Buildings and Fixtures, (XII) Hydraulic Generating Equipment, (XIII) Gas Generating Equipment.

Inspection and Maintenance Details

V. CONDENSERS

64—EXHAUSTERS—Dismantling and cleaning of.

68—EXHAUSTERS—Priming—testing of—by orifice method, obtaining data called for on exhaustive air forms.

80—LEAKAGE—Air—test for—volumetric measurement of air discharged by dry vacuum pump, followed by hydraulic or other test of system as required.

82—LEAKAGE—Same as 80, but applying to air ejector measurement.

84—LEAKAGE—Testing of—for air leakage by pressure method.

86—LEAKAGE—Water—test for—water leakage—candle flame under vacuum, silver nitrate hydrostatic test.

88—LEAKAGE—Float-operated non-return valve—testing for proper operation.

100—PACKING—Examination of—valve stem—adjusting and renewing as required.

110—PIPING AND VALVES—Air—examination of—for leaks—cleaning, lubricating and packing valve steams as required.

114—PIPING AND VALVES—Make-up and draw-off line—examination—for leakage by pressure method. Repairing or renewing as required.

VI. STEAM GENERATING EQUIPMENT

10—AIR PREHEATERS—Examination of—flue gas side, for deposit of soot; cleaning and tightening nuts and bolts as required.

12—AIR PREHEATERS—Examination of—air side, for cleanliness; testing for air leakage by operating forced-draft fan.

14—AIR PREHEATERS—Internal examination of—noting condition of tubes or plates, springs and spacers; cleaning and painting as required.

16—AIR PREHEATERS—External examination of—testing for leakage; repairing and painting as required.

18—AIR PREHEATERS—Soot blowers—examination and adjustment of—noting effectiveness of blowing.

30—ASH HOPPERS—Examination of—duplex piston, cylinder, gate, gate rollers, ash quenchers. Repairing and replacing as required.

32—ASH PITS—Examination of—for tightness and general condition of brickwork, including ash pit doors and rigging.

34—ASH PITS—Sprinkler system—examination of—all sprinklers for proper distribution of water; cleaning all openings and spray nozzles as required.

50—BOILERS—Baffles—inspection of—for loose and missing tile, broken or misplaced iron backers; repairing all leaks and breaks.

(70 other Boiler Inspection Items are covered in complete schedule.)

VII. MISCELLANEOUS MECHANICAL EQUIPMENT

Coal and Ash Handling Equipment

150—Examination of—all ladders, railings, floorings, for security and possible injury to employees.

152—Examination of—for stability and dependability of operation, lubrication of journals, shafting and driving mechanism, repairing as required.

154—Apron Feeders—examination of rolls, connecting rods, cranks and bearings for wear and lubrication, taking up lost motion and making adjustments as required.

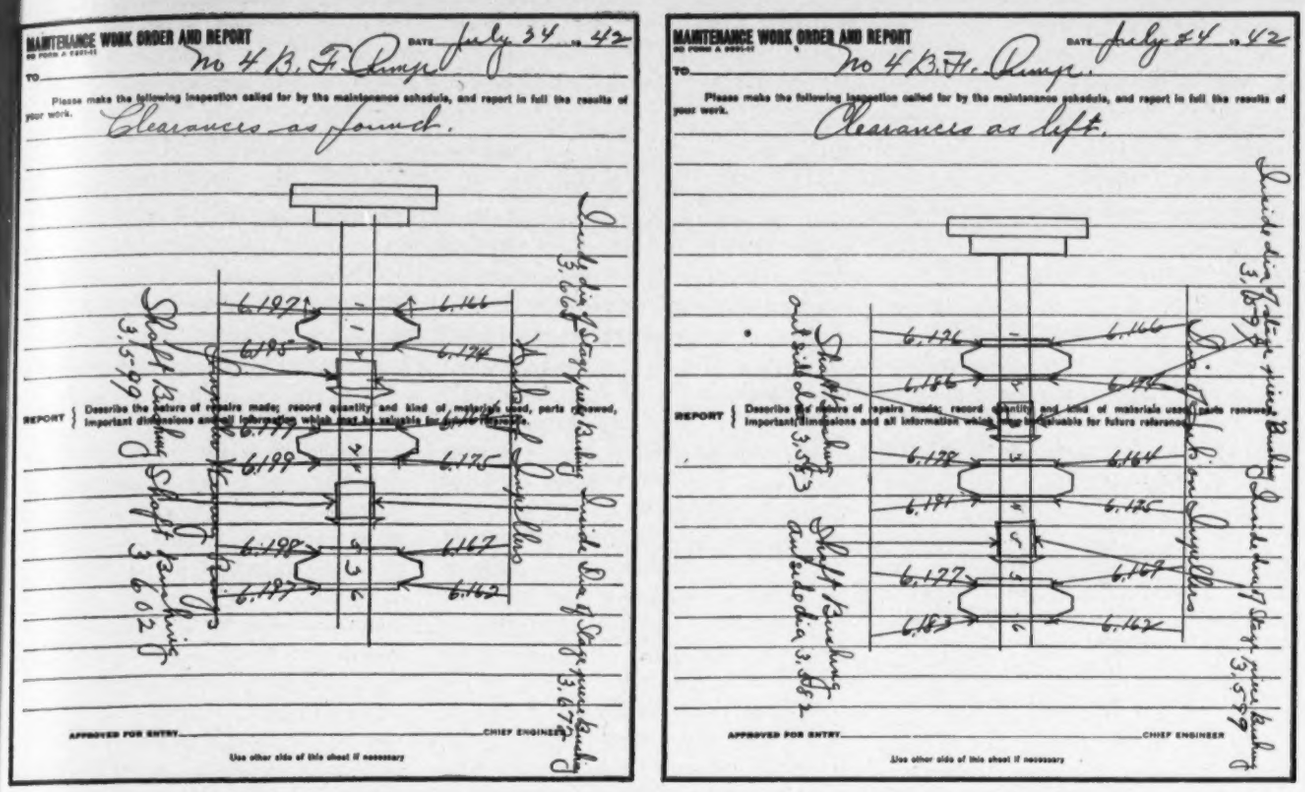
156—Ash Discharge Pipe—examination of—liners in bends, renewing as required.

158—Ash Discharge Pipe—Nozzles—Examination of—for wear, renewing as required.

160—Ash Discharge Pipe—examination of—for wear. Rotate pipe section 90 deg. when required.

162—Ash Gates—examination of—for warping, corrosion, complete closing, security; repairing when necessary; complete overhaul of air or oil cylinders, pistons, rods, etc.

164—Belt—examination of—all conveyor and drive


MAINTENANCE WORK ORDER AND REPORT
DATE July 24 1942
TO No 4 B. F. Pump
Please make the following inspection called for by the maintenance schedule, and report in full the results of your work.
Clearances as found.
REPORT
APPROVED FOR ENTRY
CHIEF ENGINEER
Use other side of this sheet if necessary
MAINTENANCE WORK ORDER AND REPORT
DATE July 24 1942
TO No 4 B.F. Pump.
Please make the following inspection called for by the maintenance schedule, and report in full the results of your work.
Clearances as left.
REPORT
APPROVED FOR ENTRY
CHIEF ENGINEER
Use other side of this sheet if necessary

SKETCHES by maintenance force showing clearance found in inspection of shaft and bearings of impellers, boiler feed pump No. 4, and clearance of this equipment as left after maintenance was completed

These equipment inspection classifications are set up in the master loose-leaf book (copies are made if required for use in additional binders about the plant) in letter-sized typed or mimeographed sheets, of which samples are presented here from twelve of the thirteen classifications.

The classifications are the equivalent of chapter headings, in a sense, and under each are listed the details of the inspection jobs to be performed on the equipment named. Each of these jobs is numbered for convenient reference. For example, under Classification (II) Steam Turbines, the sheet reprinted requires ten inspection jobs beginning with job No. 56, Horizontal Bearings, and ending with job No. 96, Horizontal Clearance. These detailed listings of inspection jobs and work to be done under each are the heart of the entire system, and when prepared for a given station are extremely voluminous and comprehensive, as they cover all the equipment in and about the plant and its structure. Thus, under Classification (VI) Steam Generating Equipment, there are 71 numbered inspection jobs listed in connection with boilers and parts thereof.

Inspection and Maintenance Details

fastenings; tightening, adjusting and relacing as required.

166—Belt—examination of—rolls, idlers and gear drive for wear, lubrication, security and alignment, noting security of chain guards.

168—Belt Conveyor Tripper—examination of—chains, gears and bearing for wear, lubrication and alignment; making necessary adjustments and replacing belt brushes as required.

(27 other Coal and Ash Handling Equipment inspection items are covered in complete schedule.)

VIII. MECHANICAL MEASURING DEVICES

CO_2 Apparatus

40—Calibration of—recorder and indicator, checking against analyses by Orsat apparatus.

44—Checking of—for zero by air test.

48—Caustic—renewal of—solution or cartridge.

50—Copper oxide cartridge—renewal of.

52—Filters—renewal of—filtering material and thorough cleaning of filter, at boiler and at recorder.

56—Filters—in water line—blowing out and cleaning as required.

60—Mercury—examination of—for proper level in reservoirs and seals; lubrication of direction valve, replacing mercury as required.

64—Piping—examination and blowing out of—gas sampling pipes as required.

68—Tubing—examination and cleaning of—tightening joints and renewing as required.

Scales

220—Boiler Room—examination of—including hopper, knife edges, levers, stirrups and scale beams; noting condition of wheels; set screws, track, etc.

222—Boiler Room—calibration of scales.

224—Track Scales—cleaning and examination of—calibrating with standard weights.

226—Track Scales—cleaning and adjustment of—regrinding or renewing knife edges as required; calibrating with standard weights.

IX. ROTATING ELECTRICAL MACHINERY

Couplings

110—Examination of—bolts, rubber buffers, bushings and retaining rings.

114—Examination of—noting condition of faces when disassembled; recording alignment of coupling ends as found and left.

118—Flexible—examination of—metal or leather disk for wear and security, noting security of flanges on shaft.

122—Geared Flexible—examination and overhaul of—noting condition of gear teeth; cleaning gear casing, removing sediment, oiling as required.

126—Geared Flexible—filling with oil as required.

130—Solid—examination of—for security, wear and condition of bolts, nuts and positive check washers.

Turbo-Generator

140—Emergency Throttle Trip—electrically operated—examination, cleaning and testing of—repairing and adjusting as required; trip to be tested by using it each time turbine is shut down.

160—Governor Control Motors—cleaning, oiling and overhauling of—bearings, commutator, brushes, windings, connections, limit devices and switches, testing rotor clearances and reliability of operation. Cleaning and adjusting solenoid brake and drum contactors or fingers, as required.

190—ROTOR—Removal of—for careful and thorough cleaning of rotor and stator; checking security of stator coils, supports and wedges; examination of coils for damaged insulation; examination of rotor and rings, truing up if required; examination of connections from field to collector rings, making repairs as required.

194—ROTOR—Testing security of all inductor bolts in.

[See next page]

In these itemizations as set up in the master book are found the complete procedure which must be followed by the maintenance forces as they carry out the inspection schedules assigned them by weeks throughout the year.

Equipment Index Sheets

The master book also contains a set of Equipment Index sheets, in which all the plant apparatus is listed alphabetically by each class of equipment or important unit having a symbol to save time and clerical work in the field and office. These sheets also give the number of the week in each year during which an annual inspection is due on a particular piece of equipment. Thus, in the sample sheet shown, "Regulators," symbol "R," are to be inspected in the tenth week of the year, while "Sump Well Pump No. 5," symbol "5 SWP," is due for inspection in the ninth week, and "Turbine No. 3," symbol "3 T," is down for inspection in the seventh week.

Another useful set of sheets in the master book is called the "Catalog of Inspections." On each of these sheets an important unit of equipment is listed with the number of inspection jobs due to be performed upon it, whether annually, semi-annually, quarterly or monthly. Thus, in the sheet reproduced for "Turbine No. 3" (symbol 3 T), 41 inspection jobs are to be done annually as listed, 32 semi-annually, seven quarterly and two monthly. Full details of these numbered inspection jobs are quickly available at all times in the previously mentioned Equipment Inspection Classification Task sheets.

The week-by-week listings of scheduled inspections are compactly set forth on one page per week, as illustrated. Each such page shows the section or classification of equipment inspection to which each job for the week applies; whether an inspection job is on an annual or other basis, and the precise items of equipment due for inspection in that week. These last are indicated by symbols to save space and time. Thus, inspections for the sixth week of the year include an annual for "10 S" (Stoker No. 10) under the classification VI (Steam Generating Equipment), a monthly inspection of "C 4" (Condenser No. 4) under classification V (Condensers), and others.

In practice, familiarity with the equipment items enables the inspection force to go over apparatus thoroughly without being obliged to prime themselves at every turn by referring to the instructions belonging to the corresponding inspection job numbers, but it is an advantage in a final check of work done to have the scope of each task outlined in connection with such numbers as set forth in the master book for the station. In the Stone & Webster system the same fundamental inspection job numbers are used in all schedules, omitting numbers which do not apply to a local station. Only the sections of the Catalog of Inspections which apply to the particular plant are included in the master book for that plant.

In operation there are, of course, weeks during which scheduled inspection jobs must be postponed, but the system provides a program for the entire year which is followed as closely as possible and completed, barring extraordinary emergencies.

Inspection Records

Inspection work orders and records are combined on $6\frac{7}{8}$ x $8\frac{3}{4}$-in. forms which show the work done upon each equipment unit covered, including repairs. One such sheet is normally required for each piece of apparatus, such as is shown for No. 4 boiler feed pump at Pawtucket. These reports are ordinarily in pencil, but may be typed if desirable, like the one illustrated. The permanent records are on legal-size loose-leaf sheets classified by equipment and filed vertically in 10 x 15-in. folders having $\frac{1}{8}$-in. borders of cellulose tape run through an edging machine to minimize wear. Two drawers in a file cabinet $16\frac{3}{4}$ in. wide x 35 in. high x 25 in. deep provide ample space for the records at No. 1 station in Pawtucket for some years to come. Permanent posting of these records, plus the preparation of work orders, occupies a fair portion of one man's time.

Inspection and Maintenance Details

X. MISCELLANEOUS ELECTRICAL EQUIPMENT

Oil Circuit Breakers

94—Thorough cleaning of compartments, blowing out contained apparatus with compressed air.

96—Examination of—tanks for leakage, replacing as required; testing oil and recording results.

98—Examination of—inspecting oil and main contacts, emptying tanks for thorough cleaning, filtering oil, drying or renewing as required, cleaning bushings.

100—Examination of bushings, fixed and movable contacts, springs, wooden operating rods, etc., adjusting and renewing parts as required.

102—Examination of bushings, cross heads, contact rods and fingers, brushes, terminal connections, upper and lower insulators, clamps and contact heads, rod contactors, etc., adjusting for perfect contact and alignment, renewing parts as required.

104—Hand-operated—cleaning and examination of —operating mechanism and adjustments as required.

106—Solenoid-operated—cleaning and examination of—operating mechanism including solenoid and auxiliary switches, adjusting as necessary.

108—Motor-operated—cleaning and examination of —operating mechanism including motor, bearings, springs, gears, contact fingers, rods, magnetic clutch, etc., oiling and adjustment as required.

Compensators

252—Starting Type—cleaning and examination of—connectors, contacts, compression springs, insulation, etc., replacing main contacts, oil tanks and renewing oil as required.

XI. BUILDINGS AND FIXTURES

Coal Storage and Unloading

10—Examination and repair of—trestles, flooring, retaining walls, walkways, railings and track.

12—Examination and repair of—booms, masts, hoists, cars, cables, pulleys, hoppers, buckets, push carts, etc.

Drinking Fountains

20—Examination of—cleaning—disposal of drip in proper manner.

Elevators

30—Thorough examination of—guide rails, pulleys, cables, doors and shaft, repairing and oiling as required.

Fire Doors

40—Examination of—for automatic closing when counterweights are raised, cleaning and lubricating wheels.

(Many further items follow in maintenance code.)

XII. HYDRAULIC GENERATING EQUIPMENT

Dams

24—Flashboards, examination of—for determination of security, repairing as required.

30—Tunnels—examination of—for cracks, leaks, drains, condition of expansion joints, lighting fixtures and wiring, repairing as required.

Drives

40—BELT—Examination of—cleaning—all belts, pulleys, idlers, etc., noting condition of surfaces and connections; lacing, cementing and dressing as needed; note tendencies of running, correcting defects, taking up slack, adjusting tension as required.

44—GEARS—Examination of—cleaning and repairing as required; note wear and noise.

Racks, Screens and Scrapers

140—Examination and cleaning of—racks, scrapers and scraper mechanisms; repair and replace as needed; lubricating gears and noting results in operation.

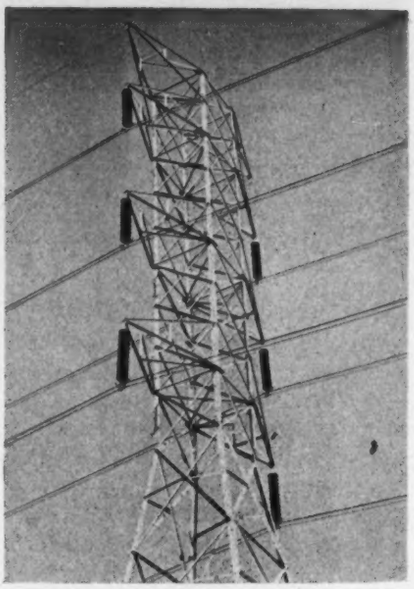
Spillways

150—Examination of—noting erosion and any vegetable growth.

(Many further items follow in maintenance code.)

Adding Conductors Raises Line Capacity

CLAYTON M. ALLEN,* Los Angeles Bureau of Power and Light



WHEN WAR INDUSTRY loads required additional power, the capacity of this 132-kv. line was increased by stringing a No. 3/0 conductor below the existing 300,000-cir.mil conductors. The shift was made one circuit at a time so as to maintain uninterrupted service

COORDINATION of wartime material shortages, emergency requirements and substitution possibilities with the normal engineering and design ingenuity of utilities is resulting in a variety of innovations in both method and technique. The means adopted by the Los Angeles Bureau of Power and Light in increasing the capacity of a twin-circuit 132-kv. line serving a war industry area in southern California falls in this category. An interesting and noteworthy installation resulted when No. 3/0 conductors were hung parallel with the existing 300,000-cir.mil wires, keeping one circuit in service so that there would be no interruption of power supply to the war plants.

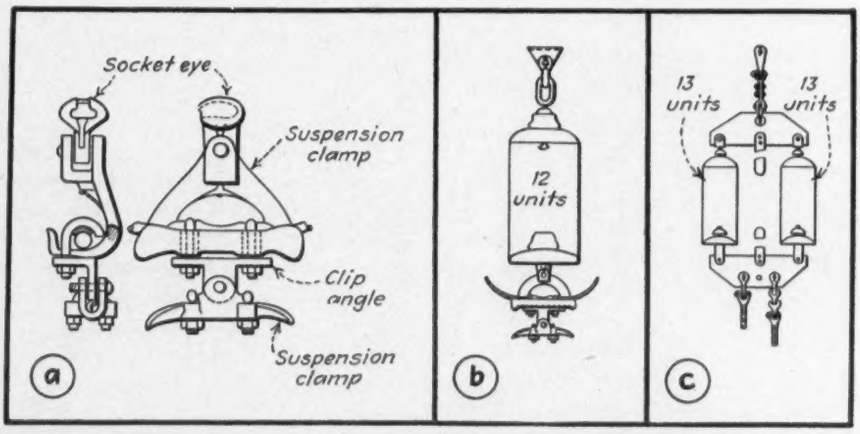
When the line was originally constructed, in the early summer of 1942, the material situation was such that it was impossible to obtain suitable priorities on the standard 500,000-cir.mil cable for which the line was designed initially. Instead two 300,000-cir.mil cables in the bureau's stocks were strung. However, because it was believed that the original load to be served might double in capacity, hardware was used which would permit the later stringing of a second and parallel 300,000-cir.mil conductor on each insulator string. The insulator assemblies consisted of twelve 10-in., 15,000-lb. porcelain ball-and-socket units for the suspension strings and two strings of thirteen units each for the deadends.

However, the load did not double, but instead new war industry plants were located in the area, bringing the demand to more than the initial line could supply. Hence the plan for adding a No. 3/0 conductor was worked out by bureau engineers in cooperation with the War Production Board. The conductor was obtained by taking down sufficient No. 3/0 cable from existing 34.5-kv. lines which were not in use at the time, thereby conserving copper.

In the initial design of the line all deadend yoke plates were drilled with the necessary holes for two parallel conductors per phase, in addition to the normal center hole for one conductor. Thus in stringing the new conductor it was an easy and simple operation to shift the 300,000-cir.mil conductor from the center to one of the side holes and to deadend the No. 3/0 conductor in the other side hole. Original "J" bolts on the 300,000-cir.mil suspension clamps were employed to attach 2x2½x½-in. clip angles from which the suspension clamps for the No. 3/0 conductor were hung.

The bureau's standard stringing technique was employed in putting up the new cables. Tension wheels were used because of the perfect control to be had over the conductor at all times. "Bull" lines on tractor-mounted winches pulled the conductor over 8½-in. roller bearing steel sheaves hung from the crossarms. The hanger rods were lengthened 4¾ in., which is the vertical distance between the 300,000-cir.mil and the No. 3/0 conductors on suspension strings. The conductor was then transferred to double-drum, truck-mounted hoists for pulling up and sagging.

The work was done with one circuit hot. Work was performed between 8 a.m. and 5 p.m. and each evening the line was cleared and energized. Only nineteen working days were required to clip in the No. 3/0 conductor on the 37 circuit-miles of line.



HARDWARE ASSEMBLIES were modified to accommodate the second conductor on the 132-kv. line. (a) shows how the second suspension clasp was attached. (b) shows a standard suspension tower setup. (c) indicates how deadend tower hardware was changed to accommodate the second wire by shifting the first clip from the center to one of the side holes in the yoke plate

*Senior electrical engineer in charge of construction planning section.

PRIORITIES PROBLEMS

Analysis of the New U-1

The new Utilities Order U-1, replacing Order P-46 as the basic priorities regulation for electric, gas, water and steam heating companies, contains many important changes in the procedures with which utilities have been working. Fundamental principles remain the same, but many restrictions have been tightened and many procedures revised to fit working experience.

Also, new restrictions and procedures are added to keep pace with the developing war program. For instance, procedures now are meshed with the Controlled Materials Plan, which means that copper, aluminum and steel are obtained with CMP allotment symbols rather than the usual priority ratings. Also, machinery is provided for the forthcoming program of mandatory use of material and equipment already in utility stocks wherever possible to minimize requirements for fabricating new supplies from scarce metals.

In the more detailed analysis of the order which follows, the provisions have been divided into major topics, with parenthetical citations of the applicable U-1 paragraphs inserted for reference.

Ratings

With this new order, utilities begin working with two kinds of priority symbols, instead of one, to obtain repair and maintenance materials and operating supplies.

For materials to be delivered this month, only the customary rating is used (par. B-1). The order provides an AA-1 rating and requisitions previously placed for materials to be delivered this month should be re-rated from the old P-46 ratings to AA-1 in order to insure delivery.

For deliveries after March 31 the AA-1 rating is used only on purchases of materials other than "controlled materials" as defined under CMP. To obtain "controlled materials" for repair and maintenance or operating supplies after March 31 utilities use the CMP symbol—MRO-U—in place of a rating (par. D-1).

As U-1 is now written, the MRO-U symbol may not be used to obtain aluminum in any form without specific prior approval from the Office of War Utilities (par. D-3). The MRO-U symbol may be self-applied for controlled materials deliveries of copper and steel within the U-1 limits by stamping the purchase order with the required certification (par. D-1). The new language for the regular priority certification to be used on non-controlled materials purchases is supplied (par. E-1).

In addition to the repair and maintenance rating, the order continues in effect the old P-46 rating for construction of transmission, switching and distribution facilities to serve rated war projects or equipment. The utility's project rating on such jobs is the lowest rating assigned the war project for delivery of controlled material or rated equipment (par. B-2). This is not a self-assigned rating; it may be used only after obtaining Washington approval. Where controlled material is involved, both a priority rating and a CMP allotment number will be assigned and both must be stamped on all orders placed which use the priority rating (par. E-1(ii).

Application for this war facilities construction rating is made in the same manner that it was made under P-46 (par. E-2). Only additional information required is the monthly schedule of controlled materials deliveries in the same manner as on a CMP-4C form (ELECTRICAL WORLD, February 20, page 58).

Deliveries, Withdrawals, Inventories

The basis for computing delivery, withdrawal and inventory quotas has been completely revised in U-1. Broadly speaking, the new quotas "freeze" maintenance and repair ap proximately at the level of the la nine months of 1942, instead of a a fixed percentage of 1940 operation —a recognition that wartime opera tions of all systems do not fluctuat alike in relation to pre-war opera tions. The nine-month period wa selected because it is the period dur ing which line extensions have been severely limited.

Scheduled deliveries of materials in any quarter—whether or not pur chased with ratings or CMP symbol —are limited to one-third the aggre gate dollar value of all materials of the same class (Schedule A) with drawn from inventory for repair and maintenance or operations in the last nine months of 1942 (par. F-1). An additional limitation restricts the wire, cable and busbar which may be ordered from a supplier to a maximum of 50 percent of the total quota (par. F-1(i). At least half of needed conductor must be obtained from other utilities.

Inventory Restrictions

A utility may not accept deliveries at all if (1) its inventory in that class exceeds a "practical working minimum" or (2) acceptance would result in an excessive inventory.

"Practical working minimum" inventory varies for different systems, but it may not exceed standards set up in the order. These standards are now calculated differently for different classes of material.

Maximum inventory of transmission and distribution material, meters, regulators, wire, cable, busbars, wood poles and crossarms is four-thirds the dollar value of material of the same class which was used in maintenance and repair in the last nine months of 1942 (par. F-2(1)); roughly a year's supply.

Inventory of material for generating station operations is limited to the dollar-value inventory in this class in 1940, plus an amount proportionate to the increase in system output during the preceding quarter compared to the comparable 1940 quarter (par. F-2(ii)). Thus, the inventory maximum in this class for the second quarter this year is the dollar value of 1940 inventory plus the percentage increase of system output in the first quarter of 1943 over the first quarter of 1940.

For switching and substation ma-

rials, practical working minimum inventory cannot exceed the dollar value of the latest 1940 inventory (par. F-2(iii)). Inventory of all other clases of material—except fuel, etc., which is unlimited (par. F-7)—is restricted to two-thirds the dollar value of withdrawals in the last nine months of 1942, roughly a six months stock (par. F-2(iv)).

Heretofore, inventory restrictions in P-46 applied only to repair, maintenance and operating supplies stocks. A new provision in U-1 establishes a 90-day maximum in the supply of designated controlled materials (Schedule B) which may be on hand for construction work, except as such excess supplies may be permitted under paragraph C of CMP Regulation 2 (par. G).

Withdrawals

Now, withdrawals! Utilities are limited in their use of materials for repair and maintenance and operating supplies in any quarter to one-third the dollar value of materials of the same class which they used in the last nine months of 1942 (par. F-3).

There are exceptions, as there were in P-46. Quotas for both deliveries and withdrawals of material for generating station operation and maintenance may be increased by the ratio of increased output in the preceding quarter this year over the comparable 1942 quarter (par. F-4(i)). Note that for generating station inventory the increase is calculated from 1940, but for the delivery and withdrawal quota it is calculated from 1942—the reason being that the quotas established by paragraphs F-1 and F-3 already reflect the increased output of that period.

Both delivery and withdrawal provisions may be exceeded for emergency repair necessitated by sabotage, explosion, fire, flood, etc. (par. F-4(iii)). Detailed reports of excess purchases and withdrawals must be filed afterward.

Short Items

The provision in P-46 permitting utilities to buy small amounts of "short items" when inventory of a particular class exceeded the limit has been replaced in U-1 with a much stricter provision.

To be eligible now to buy a "short item," in excess of quotas, a utility must set up its books so as completely to separate excess inventory in all classes of material from maintenance inventory (par. F-5). Separation of excess from practical working minimum inventory must be complete—to the point where the excess is treated virtually as another utility's stock. Separate accounting must be set up for excess stocks (par. F-5(1) (a)), excess material must be listed for sale (par. F-5(i) (b)), and all materials listed on Form WPB 921B must be filed with OWU (par. F-5(i) (c)).

In addition, excess inventory subsequently retransferred for a company's own maintenance must be treated as a delivery chargeable against the delivery quota as if it had been purchased (par. F-5(ii)).

There is a formal definition of a "short item"—any material which a utility estimates it will require for maintenance, repair or for operating supplies within 90 days of its receipt (par. A-14).

Inventory Exchange

The new order contains the regulations under which the forthcoming program of mandatory exchange of excess utility inventories is to be put into operation. Purpose of this plan is to keep to a minimum the utility requirements from inadequate supplies of raw materials, by using wherever possible an already fabricated item instead of a new one.

After March 31, except for an emergency, no utility may place an order for more than $100 worth of specified types of material (Schedule C) with a supplier without first attempting to obtain the items from its regional WPB Utility Inventory Control Office (par. J). These regional offices are now being set up.

To insure that this interchange works, the order provides that a utility may be cut off from all priorities if it refuses to sell material in its excess inventory on a bona fide offer (par. K-1). In emergencies a utility must also sell material from its own regular maintenance inventory or be subject to loss of priorities (par. K-2). Material sold from regular inventory may be replaced in the same manner as any new item of material is obtained except that the delivery is not charged against the Paragraph F-1 quota (par. F-4(iv)).

Wide latitude is available to utilities in selling excess stocks. A utility may sell any material as authorized in Priorities Regulation 13 or to any other utility on an AA-5 or higher rating (par. I-1).

Sales of equipment which do not constitute an abandonment of operations in violation of Limitation Order L-94, also may be made without specific Washington approval: To fill any order having an AA-3 or higher rating (par. I-2(i)), pursuant to authorization from the Director (par. I-2(ii)), back to the supplier (par. I-2(iii)), to a scrap dealer as scrap (par. I-2(iv)), to a used equipment dealer for resale, except items on Schedule D of the order (par. I-2(v)), or to the Army, Navy, Maritime Commission or public housing authority for use to repair an actual breakdown of utility services operated by the agency (par. I-2(vi)). None of these sales is a "withdrawal" under paragraph F-3 of the order.

Additions and Expansion

The prohibitions against additions or expansions to plant which were in P-46 are carried over into U-1, virtually without change (par. H-1). Any expansion or addition must have prior Washington approval obtained on a PD-200, PD-545, PD-1A, letter application, etc. (par. H-1(i)), unless it is a line of 250 feet or less for a new building where the foundation was complete prior to July 1, 1942, (par. H-1(ii)), or unless the project involves less than $500 worth of materials for overhead construction or $1,500 for underground construction and does not involve an extension to customer premises (par. H-1(iii)). Energizing a line already built which violates these provisions is forbidden (par. H-2).

All three of the P-46 supplemental orders also remain in existence, but with new designations as U-1-a, U-1-b and U-1-c. These modify the provisions of Paragraph H for specified conditions. U-1-a permits service extensions of not over 250 feet and costing not over $500 ($1,500 underground) to serve Army, Navy or Maritime Commission facilities such as patrol houses, etc. U-1-b allows extensions to serve ranges where the house has no range of any kind and where the extension can be made with 15 pounds or less of copper. U-1-c is the "power for food" rural lines extension order (ELECTRICAL WORLD, Feb. 20, page 59).

Editorials

S. B. WILLIAMS, *Editor*

Maintaining the Foreman's Spread

ONE of the big problems in the 48-hour week is how to compensate supervisors or foremen. They do not come under the Wages and Hours Act. They are expected to work along with their crews and they naturally expect to work longer hours. However, when the men under them get time and a half for overtime it doesn't take much before the workman's pay envelope is bigger than that of his supervisor or foreman.

The supervisor cannot have his pay raised without salary stabilization permission and to give him overtime at time and a half, in the opinion of some managers, is to invite overtime. It is, on the other hand, important to maintain the spread between the men and foremen for many reasons, not the least of which is morale.

The Salary Stabilization Unit of the Internal Revenue Bureau has not made public any rules to guide employers, but there are reasons to believe that it will approve a program that is designed solely to protect the foreman's dollar spread. Such a program can be worked out whereby the foreman gets a bonus somewhere near the spread for such periods as overtime is necessary. The basic salary is not disturbed.

One of the advantages of such a plan is that it can be adjusted for each foreman depending upon the nature of the work and the amount of overtime contemplated. In this way each foreman understands not only the temporary but the individual nature of the adjustment. For instance, the spread for line crews might be different from that for power house people. Any bonus adjustment then would recognize this difference.

This, of course, is but one suggestion that appears to have merit. Last July a report on supervisor compensation to make up for swollen pay checks of workmen was put out by the National Industrial Conference Board. Some of these ideas, if they can pass the stabilization unit, might prove more applicable in places where labor shortage brings a mandatory 48 hours. One scheme, in other words, might be better for a variable overtime and another for fixed overtime.

The matter, however, can be solved without too much headache and the relationship between such employee levels maintained.

Federal Versus State Regulation

FOUR current cases of utility regulation hold the makings of new precedents. In all four the principles at stake are basic.

In the Arkansas Power renegotiation proceedings the question of states' rights is involved. Has the federal government any jurisdiction over intrastate rates? Does it rank the state commission if the customer is a federal war agency or if it is using the power to produce war material? As we suggested when these hearings began, a clash between state and federal regulation was in the making. The National Association of Railroad and Utilities Commissioners has been instructed to intervene on behalf of the state commissions.

In the Northwest FPC has ordered Washington Water Power to permit Bonneville to use its lines to transmit power to two government jobs in the former's territory, invoking the common carrier clause in the President's directive. The commission, in weighing the relative cost of service from the power company and from Bonneville, apears to have taken the bid price without regard for any difference in federal taxes. These were not large contracts, so the amount involved was not great—only the principle.

In the nation's capital the government has intervened in a rate case against the power company as its largest customer. Although the government contends it is acting on behalf of all the customers, what it wants is a special rate with lumped billing. At the same time the government's representative from the treasury department intimated that if the district's commission didn't give it what it wants there was the possibility of invoking the President's war powers. There is a precedent for this in Puerto Rico, where two companies were expropriated.

And, finally, OPA has ruled that automatic rate adjustments, such as fuel clauses, are general increases in rates and as such must be reported 30 days in advance of application. That these clauses are part of a definite rate schedule, approved by state commissions and in force for some time, apparently makes no difference. If this is permitted to hold, is not the demand charge, power-factor clause or any similar part of a tariff designed automatically to adjust the rate equally vulnerable?

While each of these cases is different, they are all designed to contribute to the web that is being spun about local regulation. The government appears determined to be the regulatory body for all electric utilities. While the war powers of the President, under which some of these actions are taken, are very broad, it is not at all certain that the federal agencies will want to buck any concentrated action taken by organized state groups. There is no basic law to bolster the federal agencies—only their own interpretations.

This show-down between state and federal regula-

tion has been in the making for some time. The forces are now gathering, but, like many other battles, may be determined not by right, but by the terrain selected for the fight.

How Many Lives Equal $1,650,000?

ONE of the regrettable casualties of the war is street lighting. The statistics show a drop in energy consumed last year by street lighting of a little over 5 percent. Some of this is attributable to wartime, but a lot is due to dim-outs and misguided ideas of municipal economy.

The total savings from lower street-lighting bills last year were just under $1,650,000—everywhere. How much more did American cities spend for night-driving accidents and death directly attributable to poorer seeing conditions? In New York they were trebled—what were they in other places?

How many lives have to be lost, or how many people injured, to be worth $1,650,000? Do the people who must make the decision have the answer?

They Want to Know About Plastics

"START from scratch and shoot the works." That is one electrical engineer's suggestion when he was asked what he wanted to know about plastics as an electrical tool. Dozens more have admitted the same ignorance about these new synthetic compounds—a confusion of trade names and incompletely recorded and correlated properties. Other dozens have been more specific in their plea for a new approach to dissemination of applicable information about them. Woven into these comments is a refreshing willingness to get aboard the plastic band-wagon wherever it travels into the electrical domain. There is no lack of imagination or revolutionary courage to use plastics wherever they fit. But where do they fit and, out of the welter of properties, how can one pick the one product that has the ideal combination of characteristics that meets all the imposed requirements?

Naturally, electrical engineers need to know the mechanical properties of strength, elongation, machineability, hardness, impact resistance, abrasion, surface texture, aging and what kinds of tools and molds are needed to form and fabricate plastics. Thermally, they want to know maximum and minimum working temperatures (consistent with reasonable retention of mechanical and electrical properties), heat transmission and arc resistance. Chemically, the interest is principally in stability, reaction with and adhesion to metals, reaction to acids, alkalis, oils, greases and solvents and absorption of moisture. In order to distinguish between plastics (so that electrical properties can be assured) there is interest in the tests which can be applied to identify one plastic from another.

Electrically, the desired knowledge is that pertaining to dielectric strength, power factor, loss factor at various frequencies, electrical aging.

On these things hang all the lore and the profits. When electrical engineers see these properties correlated with one another to justify trial and application of a particular plastic for a specific purpose they will give free rein to their aroused interest in the accelerated art of plastics. They will then know beyond peradventure whether there is a plastic that will make secondary racks and crossarms feasible without further insulation, which ones are good for filling compounds, which can make less fragile globes and street-lamp heads, which are for high voltage and low, which for high frequency and low, which for panels and instrument cases and boxes, which for bus tubes and which for other apparatus parts.

A considerable number of electrical engineers will want to dig below this utilitarian framework to glance at the chemical foundation of a plastic. Of what hydrocarbon is it a polymer and can its stability and physical properties be correlated with the cross-link element that builds the simple chains into a complex "three-dimensional" lattice.

In short, electrical engineers know next to nothing penetratively about plastics, but they are eager to "start from scratch and shoot the works."

When Is a Co-op a Utility?

A RECENT DECISION of the Public Service Commission of Indiana in denying to a rural electric membership corporation a certificate of necessity to serve an Army field pointed out that the Army cannot become a member of a co-op and that when other than members are served the co-op becomes a public utility.

This decision raises the whole question of regulation of a co-op. Can a co-op take as members industrial concerns, retail stores, railroads, cities, post offices and the like? If a co-op serves any one other than a member, is it not engaged in a commercial transaction for profit? And when it is so engaged, is it not subject to the same regulation as any other utility?

During the past two years rural electric co-ops have been very active in seeking load outside their membership—sometimes very large loads, as in the case of the Ark-La Co-op. Under such circumstances, can the co-ops maintain immunity from state regulation? They are not government or state or municipally owned, although the money for construction was borrowed from a federal agency.

A co-op seeking business outside its membership is the same as a utility company seeking load outside its stockholders. Viewed that way, the problem of co-op regulation becomes much clearer.

Washington Comment

By RICHARD LARKIN, Washington Staff

The Minimum Home Use of Energy in Wartime

EVEN in a bedrock minimum civilian economy for wartime the only worthwhile gains available from reduction of America's electrical standard of living at home are those which could be realized by outlawing waste and extravagance. Any drop in residential use of electricity below 97 percent of 1941 consumption would detract more from fighting the war than it would help.

This is the viewpoint of WPB's Office of Civilian Supply, expressed as part of a report to Economic Stabilizer James F. Byrnes, who asked how much could be pruned away from the civilian economy without adversely affecting health, efficiency and morale.

Food and Clothing Lower

What OCS has done has been to set up for each component of the living standard an estimate of the point of diminishing returns—an estimate of the point beyond which material and manpower savings would not equal the damage to the home front. Most of the components surveyed yield greater savings than those OCS finds available in electric service.

For instance, OCS feels that food could be reduced to 71.8 percent of 1941 consumption before diminishing returns would set in. Clothing could slump to 64 percent of the same base. Only 40 percent of the 1941 auto fuel is considered to be bedrock for maintenance of the home front.

The report, of course, is a bit like an eighth-place ball club in mid-September; it's not going anywhere—isn't even intended to. It isn't a recommendation and it isn't final. It is admittedly empirical in some places and revisions which are due in about a month are being prepared.

Neither the planners who drafted it nor Byrnes, who asked for it, intended the report as a blueprint to be put into effect. The report itself carries a notation that many phases of the civilian economy are currently being planned at materially higher levels than the bedrock listings simply because there is excess capacity over and above military, export and bedrock civilian needs. Failure to use these residual quantities for civilian purposes, the report notes, would be pointless.

Purpose of Report

However, the report does have its purpose. It is intended, by delineating the "danger points" for civilian items, to provide criteria for judging what the working population can tolerate and still function effectively. In the matter of food requirements, for instance, the report has considerable meaning. There is every possibility that before 1943 is out the civilian food supply may approximate the bedrock minimum requirements. If this happens, the report provides advance warning to all concerned that no real economy can be achieved below the 71.8 percent level of the OCS report.

As regards home electric service, the warning that the report sets up has no practical meaning, since there is no likelihood that the power situation will become bad enough to raise the question.

The value of the report stems from the manner in which the findings were reached rather than from the erection of a danger sign to guide home use of electricity. Inherent in setting the "bogey" at 97 percent of 1941 consumption is OCS' recognition of the fact that there are many vital home functions which must be performed to maintain life and health, and that most of these are now being performed to a greater or lesser degree with electricity. To stop the flow of kilowatt-hours would be to require alternate methods to carry on these household functions—methods which would be less efficient and which would require more materials.

Refrigeration is a good example. Considerable savings of electric current could be made if electric refrigeration were banned. But OCS recognizes that refrigeration of some kind is essential, and that there aren't sufficient substitute ice boxes or adequate means of icing them. Curtailment of electrical refrigeration, then, would save plentiful kilowatt-hours at the expense of scarce wood, metal, ice-manufacturing equipment, tires, gasoline and manpower. This violates the law of diminishing returns. Reasoning thus, OCS concludes that in a bedrock civilian economy, the contribution from domestic electric refrigeration would be only the amount which could be saved by having housewives defrost properly, pre-cool foods and by opening the door as little as possible. This could save perhaps as much as 15 percent of the current they will use this year.

Appliance Use

Similar reasoning was applied to such other essential current uses as lighting, ranges, radios, irons, water heaters and washing machines, all of whose minimum requirements are rated between 85 and 100 percent of anticipated 1943 use. Lighting, too, OCS would cut only 10 percent—by eliminating holiday displays, by not leaving the porch light on until junior comes home at night, by not using more lamps than necessary inside the home. Only electric clocks, oil burners and space heaters, among electrical appliances, are recommended for cuts below 85 percent.

With the bedrock estimates determined on this logical basis in the original report, it is unlikely that drastic reductions will be made in the forthcoming revision. Officials concerned say that the greater part of the fat came off in the first treatment and that further pruning would require greater cuts than they are willing to advocate right now. And inasmuch as the savings come from elimination of waste, there's not much reason to believe that the revision will add to the original minimums.

NEWS OF THE WEEK

OCS Demands Sharp Cut in Non-Vital Electricity Use

Savings in fuel and transportation facilities cited by agency, in strong plea to war administration, as reasons for virtual "brownout" — Two billion kw.-hr. saving seen

Curtailment of non-vital civilian use of electricity as a means of saving appreciable quantities of fuel and transportation facilities has been "strongly urged" upon the war administration by the Office of Civilian Supply.

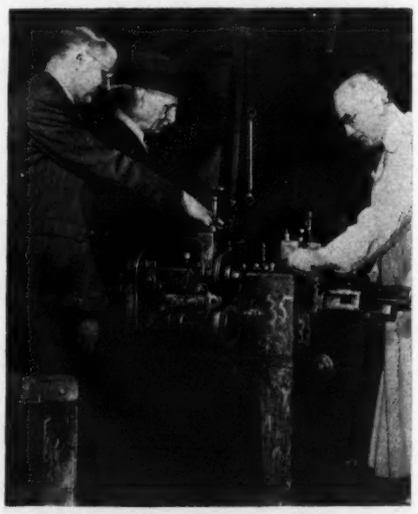
"Brownout" Still Languishes

The OCS proposal is less drastic than the "brownout" proposed by the Office of War Utilities. The "brownout" is now languishing because of antipathy shown toward it by Transportation Boss Joseph B. Eastman and Fuel Czar Harold L. Ickes (ELECTRICAL WORLD, February 27, 1943, page 6).

Basing its proposal on the inconsistency of burdening transportation and fuel production to allow unrestricted use of electricity to advertise commodities which are being rationed or supplies of which are inadequate, OCS submitted the following two-point program:

1. All outdoor illuminating signs or signs using current for other purposes, all outdoor floodlighting for advertising, display or decorative purposes, all theater marquee lighting in excess of 1 watt per sq.ft. on the under surface, all entrance lighting in excess of 1 watt per sq.ft. of ceiling over the entrance and all shop window lighting in excess of 25 watts per linear foot of glass window parallel to the sidewalk is prohibited with these exceptions:

One 250-watt or smaller identification sign attached or adjacent to business or public places (one sign to an entranceway and no more than two to one building), street and highway signs, traffic signals and other safety signs and floodlighting for playing fields or other mass meeting or recreational places is allowable. Street and highway lighting shall not exceed 2 kw. per 100 linear feet of thoroughfare.



BOTTLENECK BREAKER—Frank Shermer, industrial engineer, Philadelphia Electric Co. (left), is the 250th lighting craftsman to win the gold "bomber builder" lapel pin. He is shown here with F. E. Ellis, production superintendent of Reading Screw Co., and W. C. High, manager of the same plant. With lighting bottlenecks broken, Mr. High demonstrates the faster rate of output

2. "A program for elimination of waste in use of electric energy. This should be based on a continued campaign of appeals by the government and by utilities to all consumers."

This program, OCS maintains, makes for the largest possible savings with the least dislocation of the civilian economy and the minimum administrative difficulties. OCS seeks no curtailment which affects production or the ability to produce and which hurts morale.

See 2 Billion Kw.-Hr. Saving

Savings which would result from the OCS program are admittedly short of those possible under the OWU proposal, but are imposing nevertheless. OCS claims its program would save approximately 2,000,000,000 kw.-hr. yearly and about 1,000,000 kw. in evening peak load. Coal or equivalent savings would be well over 1,000,000 tons yearly. Up to 500,000,000 ton-miles of freight also would be saved yearly, as well as hundreds of train loads of fuel.

While admitting that curtailment of commercial loads would have an adverse effect upon revenues, OCS held it "probable" that increasing war loads would make up for "a large part" of the losses despite the differential in average commercial and industrial rates.

The program, which OCS describes as a "modified dimout," would be instituted nationwide without exceptions.

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High Court to Act on "Death Sentence"

The last obstacle to a final test of the constitutionality of the "death sentence" provisions of the Holding Company Act was removed this week when the Supreme Court agreed, at the request of both the North American Co.

and the Securities and Exchange Commission, to review a decision of the Federal Circuit Court of New York sustaining the legislation.

Action by the SEC the week previous in joining the petition of North American Co. for a review of the lower court's decision was prompted, the commission said, by a "substantial public interest in an early determination of the constitutionality of a crucial provision of an act designed to integrate and simplify a $15,000,000,000 industry." In its petition the commission reaffirmed its contention as to the legality of the "death sentence".

The commission pointed out that two other appeals were pending before circuit courts in various parts of the country in addition to five appeals from orders handed down under Section 11 (b) (2)—the corporate simplification phase of the "death sentence." Furthermore, the commission said in urging a speedy high court decision, more than 20 proceedings were pending before the SEC under Section 11 (b) (1) and more than 40 proceedings under Section 11 (b) (2).

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Pass New York Water Power Bill

Both the Senate and Assembly of New York state have unanimously approved and sent to Gov. Thomas E. Dewey the Feinberg bill to empower the water power and control commission to collect, from July 1, 1943, equitable rental for diversion of Niagara River waters for power purposes. Under the bill, recommended to the Legislature by the Governor, diversion of any waters from such rivers are made illegal unless by authority of license from the commission. In addition, all waters of the state in which the people have "proprietary interest" in the flow shall be diverted only subject to the state's control to regulate, license and charge rental.

Following passage of the measure, another bill was introduced by state Senator Samuel Gutman, Brooklyn Democrat, to amend sections of the conservation law which created original grants to the Niagara Falls Power Co., permitting the diversion of Niagara waters for power purposes. The power company has contended that the statutes conferred a perpetual grant to the use of waters. Purpose of the new bill, its sponsor said, is to provide that the statutes granting the rights to divert waters be subject to the provisions of the conservation law requiring payment of rental for such diversion.

Government Seeks Cut in Washington Power Rates

Both the OPA and Treasury's Procurement Division intervene in D. C. commission hearing on Potomac Electric's sliding-scale rate agreement — Commission limits hearing to agreement

The federal government opened a two-pronged attack this week upon the rate regulatory procedures of the District of Columbia Public Utilities Commission. At issue are the rates of Potomac Electric Power Co., which since 1925 have been under a sliding-scale agreement that produced a rate reduction annually until last year.

Violate Price Control Act

Government intervention came from the Office of Price Administration and from the Treasury Department's Procurement Division. OPA moved to abolish the sliding-scale agreement and force a revaluation proceeding in an attempt to bring about a rate cut, despite the fact that the Price Control Act specifically authorizes OPA intervention in utility rate matters only where increases are being sought. Treasury Procurement intervened as Pepco's largest customer—the government uses about one-fourth the energy consumed in Washington—with threats of public ownership or seizure of the property under the War Powers Act unless the commission acts "favorably."

Over the objections of the government agencies, however, the commission decided to limit its hearing to whatever changes may be possible under the "sliding-scale" agreement, leaving to a subsequent hearing the question of abrogation or revision of the "sliding-scale" plan.

The Pepco case marks the third major instance in recent weeks in which the government has acted to impose its will in power matters where it is a customer, regardless of existing state or local regulatory agencies. The other cases involve the Federal Power Commission's attempt to fix the intrastate rate between Arkansas Power & Light Co. and Defense Plant Corp. for service to the Lake Catherine, Ark., aluminum mill, and FPC's order directing Washington Water Power Co. to transmit Bonneville Power Administration energy over its lines to serve an Army camp and hospital in the utility's service area.

OPA's tangle with the district commission marks the second time within a year the price agency has sought to override the regulatory body on rate matters. Still pending in the courts is OPA's appeal from the commission's rejection of OPA's demand for a formal valuation proceeding for the Washington Gas Light Co. and for abrogation of that utility's sliding-scale contract which, in 1942, worked out to allow a $200,000 rate increase.

Thurman Hill, counsel for the Procurement Division, in announcing that the Treasury also would intervene in the Pepco case, issued a statement saying:

"This does not mean that we do not feel that we have other remedies, since we have a specific contract. We feel that other remedies, such as an agreement on a special rate, public ownership, or perhaps other methods provided by Congress under the War Powers Act, might be exercised by Treasury Procurement."

The Procurement Division attorney said the intervention is in behalf of all consumers, as well as in behalf of the government as a "substantial party at interest." For itself particularly, the government wants all energy it consumes at some 700 locations in Washington lumped into two composite bills—one for high-voltage energy and one for low-voltage energy.

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70,000-Kw. Unit Operating at Coulee

First of the two 70,000-kw. Shasta Dam generators which WPB ordered shifted to Grand Coulee Dam last year to speed expansion of Pacific Northwest generating capacity for war loads was put into service on February 25. Transfer of the unit from its originally intended location which isn't yet ready makes the power available a year sooner than would be possible at Shasta.

Addition of the generator pushed Grand Coulee's installed capacity beyond the 400,000-kw. mark. Scheduled additions at Coulee later this year and early in 1943 will approximately double this capacity. Because the Shasta units are left drive and Coulee's generator housings are right-handed, the Nos. 4, 5 and 6 stalls are being used for the two generators.

Krug, Utilities Czar, New WPB Vice-Chairman

Will have charge of materials allocation and the job of co-ordinating production schedules as virtual successor to Eberstadt — Retains utilities post in latest WPB shift

J. A. Krug this week was appointed vice-chairman of the War Production Board in charge of all materials allocation and the job of co-ordinating production schedules. Krug will continue to hold his position of director of WPB's Office of War Utilities in addition to his new post.

Reports to Nelson, Wilson

The appointment makes Krug the No. 3 man in the WPB hierarchy, ranking behind only chairman Donald M. Nelson and production vice-chairman Charles E. Wilson. Exact scope of his duties had not been formally outlined by mid-week, but Krug's vice-chairmanship, in essence, is the job from which Ferdinand Eberstadt was dismissed by Nelson last month.

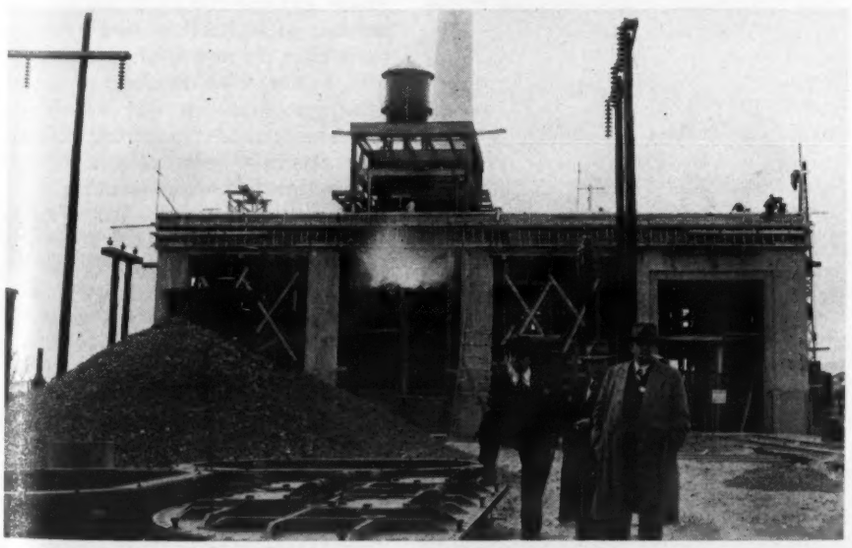
The vice-chairmanship carries with it the chairmanship of WPB's requirements committee, which divides total supplies of raw materials among the various claimant agencies, and the directorship of the WPB program bureau, which co-ordinates the various production schedules of the war effort. In these capacities Krug will supervise the workings of the Controlled Materials Plan.

Chief difference between Krug's post and that held by Eberstadt is understood to be that Krug will definitely report to production boss Wilson, whereas Eberstadt was Wilson's co-equal. It was this equality of authority which led to the explosive showdown resulting in Eberstadt's dismissal and the emergence of Wilson as the top operating executive in WPB.

Victory for Scheduling

Wilson's victory was a victory for scheduling over allocations as the reigning administrative philosophy of WPB—that is, materials are allocated on the basis of production schedules rather than having schedules written to conform to the amount of materials allocated. Krug's appointment strengthens this trend, inasmuch as WPB's power division, under Krug, was the first war unit to go to formal scheduling, and has been scheduling power expansion for more than a year.

Decision to have Krug remain as the utilities czar rests in the admitted importance of having a "strong man" directing the wartime power, gas, water and communications programs. Recent creation of the Office of War Utilities with Krug as director came with White House approval after a long internal governmental fight for jurisdiction over utilities. The action solidified WPB's authority in this field.



CHECKING THE PROGRESS—Inspecting the Arkansas Power & Light Co.'s new $3,000,000 steam-electric generating station are, left to right, Robert Bruce, superintendent of Memphis Generating Co.'s Fourth St. plant; W. N. Wolford, superintendent of construction of the new Arkansas plant, and C. S. Lynch, executive vice-president of the company. Work was started last July and if the 30,000-kw. G.E. generator for the plant is delivered on schedule in April, Mr. Lynch said, operation of the new plant may be started in four months

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Middle West Corp. Integration Planned

Plans for the disposition of about 60 percent of the properties of the Middle West Corp. and the integration of the remaining 40 percent, in compliance with "death sentence" provisions of the Holding Company Act, were announced recently by Purcell L. Smith, president. The corporation intends to go ahead with its plans, Mr. Smith indicated, along those lines described to the commission, but without awaiting a final order from the federal agency.

Principal steps to be taken this year include the following: (1) Dissolution of North West Utilities Co. and the distribution of its holdings to Middle West shareholders. (2) Middle West will move toward the ultimate dissolution of its interests in Kansas Electric Power Co., Missouri Gas & Electric Service Co., Pecos Valley Power & Light Co., Michigan Gas & Electric Co. and Middle West Utilities of Canada, together with miscellaneous smaller holdings of stocks in both affiliated and non-affiliated companies. (3) Public Service Co. of Oklahoma will ask SEC permission to acquire the assets of Southwestern Light & Power Co., which will then be dissolved. (4) West Texas Utilities Co., now in process of acquiring all the outstanding securities of Pecos Valley Power & Light Co., will take over the remaining assets.

Stocks received through merger or reorganization of Central and Southwest Utilities and American Public Service Co. will be distributed to Middle West shareholders. Upon completion of the plan Middle West will consist of Central Illinois Public Service Co., Kentucky Utilities Co. and the Public Service Co. of Indiana.

Decision to proceed with the integration plan, Mr. Smith said, was based on a recent decision of the U. S. Supreme Court in the Federal Water Service Corp. case (ELECTRICAL WORLD, February 6, page 61) which held that purchases of stock of a corporation by officers or directors, while reorganization proceedings were pending, was not prohibited.

New England Energy Interchange Defended

Boston Edison-New England Power agreement on steam-hydro ties viewed as economical in utility systems

A vigorous defense of the interchange agreements between the Boston Edison and New England Power companies featured a recent hearing at Boston before the legislative committee on power and light, in connection with a bill (Senate 120) providing for an investigation of the production, operating costs and rates of these utilities by a special unpaid commission. Senator M. M. Goldman appeared in behalf of this legislation and attacked the existing power contracts as unfair to the customers of the Edison company. F. M. Ives, general counsel for the Edison company, and Sheldon E. Wardwell, for various Massachusetts utilities, spoke against the bill.

Misapprehension as to Prices

Mr. Ives asserted that those in support of the bill labored under a misapprehension as to the equity of the prices charged for energy interchanged. He pointed out that in 1941 the Edison company sold New England Power 165,605,000 kw.-hr. for $1,787,503 (averaging 1.079 cents per kw.-hr.), and that the advocates of the bill had made a high error of over 7 mills per kw.-hr. in figuring this cost. In 1928 the Edison system demands were rising at the rate of 10 to 15 percent a year, and Jackson & Moreland, its consulting engineers, recommended the establishment of a power pool with New England Power instead of the construction of a new steam plant on the recently purchased site at Everett, Mass. It was shown that in five years the construction by New England Power of the Fifteen Mile Falls hydro-electric development on the upper Connecticut, with transmission and substation facilities to tie into the Edison system in northern Massachusetts, would save $900,000 in carrying charges on the Everett plant. Edison and New England Power therefore contracted for the supply of 75,000 kw. for 2,000 hours per year from Fifteen Mile Falls at a price to Edison of $2,025,000, or 1.35 cents per kw.-hr. Delivery of this energy began in 1930, the contract providing for review every five years and arbitration if required.

In the second five years of the contract H. G. Wells, former public utility commissioner in Massachusetts, arbitrated the price to a lump sum of $1,575,000 or 1.05 cents per kw.-hr. During the third five years former Gov. J. B. Ely of Massachusetts arbitrated the price to $1,762,500, or 1.175 cents per kw.-hr., and the companies are operating on this finding. During the great depression the contract was found not to be improvident by the Massachusetts commission in an Edison rate case, although it had been criticized by champions of rate reduction. Had the depression been foreseeable, neither the Everett plant nor the Fifteen Mile Falls development would have been required at the time, but major economies have resulted from the interchange, and as the Edison loads grew in the 1930's the tie-in proved more and more valuable.

Misconceptions as to prices grow out of failure of Senate 130's advocates to understand the relation of increment power to interchange, Mr. Ives said. Merely for assumption purposes, if New England Power finds that at a certain period of the day it would cost it 6 mills per kw.-hr. to produce energy and Boston Edison's increment cost at that time with the spare steam capacity available is 3 mills, the two utilities split the difference, Edison selling at 4.5 mills to New England. The result is that New England saves 1.5 mills and Edison makes 1.5 mills. Very rarely does it arise that energy moves between the two systems in opposite directions at the same time (there are several ties). No firm has been sold by Edison to New England Power as yet, but Edison has agreed to the sale of 40,000 kw. on a 2,000-hour basis after the new Everett station goes into service, New England to pay the same price for this that Edison pays for firm power from New England. Contracts have been executed for dump power transfer when available.

In his appearance, Mr. Wardwell cited the favorable regard of the Federal Power Cimmission for interconnection operations in eastern New England.

TIES THAT BIND—New England System Operators reviewed interconnection values at recent annual meeting in Boston featuring energy interchange as vital war resource. L. to r., seated, Earle Wilde, WPB, Washington, guest speaker; W. B. Carnie, Montaup Electric, retiring chairman; F. A. Hubbard, New Bedford Gas & Edison Light, guest speaker. Standing, l. to r., A. T. Haendler, Boston Edison, secretary-elect, and Donald P. Reed, New England Power System, Millbury, Mass., chairman-elect

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WPB Field Offices Handling PD-1A Forms

PD-1A applications for priority assistance should now be filed with the nearest of WPB's 131 district field offices. After March 15 the twelve regional WPB offices will issue ratings on those applications which require $100 or less of materials.

This new procedure represents a long step in the decentralization of WPB activities and provides industrial men with field assistance in properly preparing

applications and in getting prompt action on small orders which comprise the bulk of PD-1A applications. It is anticipated that as the system becomes established the value limit of applications which will be authorized through regional offices will be increased so that 80 percent or more of all PD-1A's will be handled in the field.

Under the new procedure the district field offices will be responsible for seeing that applications are properly filled out. They also will forward them to the proper authorizing agency—the regional office on small orders and to the proper WPB industry division on larger ones.

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Nine Regional "TVA's" Proposed

Rankin bill duplicate of one introduced at last session

Nine regional authorities, similar to and including TVA, would be established under a bill introduced in Congress by Rep. John E. Rankin, Mississippi Democrat.

The bill, a duplicate of one introduced last session, was referred to the House rivers and harbors committee. Its predecessor was not reported.

Agencies proposed are the Atlantic Seaboard, Great Lakes-Ohio Valley, Tennessee Valley, Missouri Valley, Arkansas Valley, Southwestern, Columbia Valley, California and Colorado Valley Authorities, all similar in intent and scope to TVA. Receipts of each, with the exception of a $500,000 contingent fund, would revert to the Treasury and each would be dependent on Congress for operating and capital expenses.

TVA would not be affected by this act except in so far as the Rankin bill adds to its authority. The Cumberland River Basin would be added to its existing domain. The Bonneville project would be taken over by the Columbia Valley Authority.

Authorities would have power, among other things, to acquire, construct and operate generating and distribution facilities. They would be required to give preference, in disposing of authority-generated electric power, to nonprofit distributors. Where an authority found farms or rural communities not "adequately served at reasonable rates" it could sell power direct to the consumer.

Practices and rates governing resale of authority-generated power by public or private purchaser would be under jurisdiction of the authority.

Cites Utilities' Ability to Meet Competitive Power

Stone asserts investment and operating expenses per kw.-hr. sold are substantially less than 1929 figures — Credits better system results to performance of equipment and insulation

E. C. STONE, vice-president of the Duquesne Light Co.

Progressively better utilization of utility system facilities over the last decade is shown by the fact that typical system investment per kilowatt-hour sold is less than 60 percent of the corresponding figure for 1929. This was emphasized by E. C. Stone, vice-president of Duquesne Light Co., in a luncheon talk at the sessions of the Pennsylvania Electric Association's electrical equipment committee in Pittsburgh, February 25 and 26, 1943. Much of the credit, he added, is to be accorded to better performance of equipments and of insulation in general. As a consequence, he said, the industry is better able than ever to meet competition from alternative forms of power. Operating expenses per kilowatt-hour are down about 25 percent.

Income Drop per Kw.-Hr.

All this he felt is encouraging, despite such contrary factors as the drop of some 60 percent in gross income per kilowatt-hour. Those still critical of sustained earnings of the industry seem not to realize that the many millions of added capital expenditure must be supported even if only at the greatly reduced return which all industry capital earns under present low interest conditions. Stone assured his engineer listeners that they could justifiably look to the future with confidence.

Wartime Equipment Loading

In the sessions W. C. Bowen of West Penn presented a comprehensive summary of Pennsylvania practices and of national literature regarding the wartime loading of equipments and circuits. Several members called attention to sizeable gains in capacity by resort to the simple expedient of opening station windows when the ambient is low. Circulation of oil from and to the good-oil tanks helped a station transformer to carry an emergency load in one instance cited.

A similar compilation of plant protection and blackout measures was presented by H. H. Marsh, Duquesne Light; that company reported moves to cascade practically all street light circuits so as to relieve wardens of responsibility. B. E. Hagy showed pictures of a large Philadelphia 66-kv. substation built in 1942 for which the copper was 1/20 and the steel 1/30 as much as an equivalent structure built in 1923.

Visit Westinghouse Plant

The committee visited the Westinghouse plant at East Pittsburgh to continue a discussion of air-blast circuit breakers begun at the Pittsburgh sessions when H. A. P. Langstaff and L. R. Ludwig described the design and performance of the 138-kv. Westinghouse 2,500,000-kva. air-blast breaker on the West Penn system. The units have been operated some 60 times, six of which were automatically on faults; only minor developmental troubles were reported.

One of the utilities reported a large number of ingenious expedients to get around shortages of equipments and materials; they included an oxide film arrester tester, several schemes for short-circuit drying of transformers in place, drying air blown through pipe connected across a transformer secondary (with regulator), jacks to relevel a sagging machine foundation, silver plating under water to avert overheating of associated insulation material.

Co-op Membership Rules Defined

The Public Service Commission of Indiana, in a far-reaching opinion of recent date, has ruled that a local Rural Electric Membership Corporation cannot accept the United States Government, or any one of its departments or any manufacturing or industrial concern for membership. In so doing, the opinion points out, the Rural Electric Membership Corporation would be departing from its legal sphere of a mutual non-profit association and entering the profit-seeking public utility field, an eventuality never intended by the Rural Electric Membership Corporation Act or articles of incorporation, it was ruled.

This significant opinion, signed by Commissioner William A. Stuckey, with Commissioner Barnard concurring and Eichorn not participating, was rendered in granting the Indiana Service Corp., Fort Wayne, a certificate of "convenience and necessity" for the construction, operation and ownership of distribution facilities to serve an Army air field, in territory previously granted to the Adams-Wells Rural Electric Membership Corporation.

"As soon as a Rural Electric Membership Corporation begins serving non-rural customers, who cannot legally be admitted to membership in the local corporation, then that Rural Electric Membership Corporation becomes to all intents and purposes a public utility," the opinion said.

"This was never intended, for the Rural Electric Membership Corporation Act specifically limits the commission's jurisdiction to the approval of rates and the granting of certificates of convenience and necessity for authority to serve rural inhabitants in certain defined territory."

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Lower Price Schedule Announced by Alcoa

Roy A. Hunt, president of Aluminum Co. of America, has announced that, as a result of a renegotiation agreement entered into with the government, Alcoa put into effect on March 1 a new and lower schedule of prices for semi-fabricated and fabricated aluminum.

Mr. Hunt stated that increased volume of production, together with new and improved technique and equipment, have greatly reduced many costs and therefore Alcoa considers as reasonable the requirements in its renegotiation agreement which eliminate those profits which the government felt were excessive.

He also stated that, as illustrated by this new schedule and by the four reductions in the price of aluminum ingot lowering that price from 20 cents in 1939 to its present level of 15 cents a pound, it is the company's policy to pass on to consumers the benefits of its improved manufacturing conditions and research in the form of lower prices.

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Kill Proposal to Buy N. Y. Utility

A proposal by Mayor F. H. La Guardia that New York City buy and operate the Staten Island Edison Corp. as a municipal "yardstick" on electric rates was killed by the New York City council last week by a vote of 16 to 7.

The original proposal, sent to the City Council last August, called for payment of a sum not exceeding $16,500,000 for the plant, subject to approval at a city-wide referendum. Later, Mayor La Guardia said that the maximum price the city would pay would be $14,500,000. Unfavorable action by the council on the measure was said to be due to testimony of Willard F. Hine, consulting valuation engineer of the Public Service Commission, that the physical plant of the utility had a value of $7,183,416, as of December 31, 1941. His testimony was given before the finance committee of the City Council, which voted to reject the proposal.

Staten Island Edison Corp. is a subsidiary of Associated Gas & Electric Corp., which is under Securities and Exchange Commission orders to divest itself of all interest in its subsidiaries.

Commenting on the City Council's action, Mayor La Guardia predicted that his plan would win in the end. The time will come, he said, and in the not too distant future, when New York City would acquire not only the Staten Island Edison Corp. but will also own the Consolidated Edison system. When the Public Service Commission completed its evaluation of the State Island property, he added, a final offer for the plant would be made by the city.

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Public Power Bill Killed in Arkansas

By a vote of 57 to 34, the House of Representatives of the Arkansas Legislature defeated on February 24 a bill which would authorize cities and towns to purchase light plants and distribution systems for municipal operation through the issuance of revenue bonds. Present laws provide that such purchases can be made, but through bonds issued as a lien against all property in the city or town to guarantee payment.

The measure, introduced by Miss Alene Word, Osceola lawyer, brought forth more than three hours of debate. Its opponents termed it dangerous because of its socialistic tendencies and trend toward government ownership. Its sponsor denied that it was aimed at the Arkansas Power & Light Co.

MEETINGS

Council of Electric Operating Companies—Annual meeting, Palmer House, Chicago, Ill., March 19. Tom P. Walker, president, 324 Home Bldg., Washington, D. C.

Oklahoma Utilities Association — Conference of executives and department heads of member companies, Tulsa Hotel, Tulsa, Okla., March 22. Miss Kate A. Niblack, secretary, 625 Biltmore Hotel, Oklahoma City, Okla.

Association of Iron and Steel Engineers—Spring conference, William Penn Hotel, Pittsburgh, Pa., May 10. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Arkansas Utilities Association — Annual convention, Marion Hotel, Little Rock, Ark., May 10-11. R. E. Ritchie, secretary, P. O. Box 551, Little Rock, Ark.

National Fire Protection Association — Annual meeting, Palmer House, Chicago, Ill., May 10-14. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Wholesalers Association—War conference, Hotel Statler, Buffalo, N. Y., May 24-26. Alfred Byers, secretary, 165 Broadway, New York, N. Y.

Previously Listed

Southeastern Electric Exchange—Engineering and Operation Section, Henry Grady Hotel, Atlanta, Ga., March 25-26. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Electrochemical Society — Spring meeting, Hotel Roosevelt, Pittsburgh, Pa., April 7-10. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

American Institute of Electrical Engineers—Northeastern District, Wendell Hotel, Pittsfield, Mass., April 8-9; Southwestern District, Kansas City, Mo., April 28-30; National Technical Meeting, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

Midwest Power Conference — Palmer House, Chicago, Ill., April 8-9. Stanton E. Winston, conference director, Illinois Institute of Technology, Chicago, Ill.

Missouri Association of Public Utilities—Annual business meeting, Elms Hotel, Excelsior Springs, Mo., April 16-17. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., April 20-23. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

North Central Electrical Industries—Annual all-industry conference, Radison Hotel, Minneapolis, Minn., April 26-27. Wm. A. Ritt, secretary-manager, Foshay Tower, Minneapolis, Minn.

American Society of Mechanical Engineers—Spring meeting, Hotel Black Hawk, Davenport, Iowa, April 26-28; semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-18. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Missouri Valley Electric Association — Annual engineering conference to be held in conjunction with meeting of 7th District American Institute of Electrical Engineers, Continental Hotel, Kansas City, Mo., April 28-30. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

February's End in Output Drop

Following the previous week's unseasonal rise in power output, the curve re-established the normal February decline as the month ended. Figures on the amount of electrical energy distributed by the electric light and power industry for the week ended February 27 totaled 3,892,796,000 kw.-hr., according to the Edison Electric Institute, as compared to a total of 3,948,749,000 kw.-hr. for the preceeding week and 3,939,708,000 kw.-hr. for the week of February 13. The latest week's figures bring the percentage of increase over the corresponding week in 1942 to 14.2 percent. The previous week's gain had been 15.3 percent.

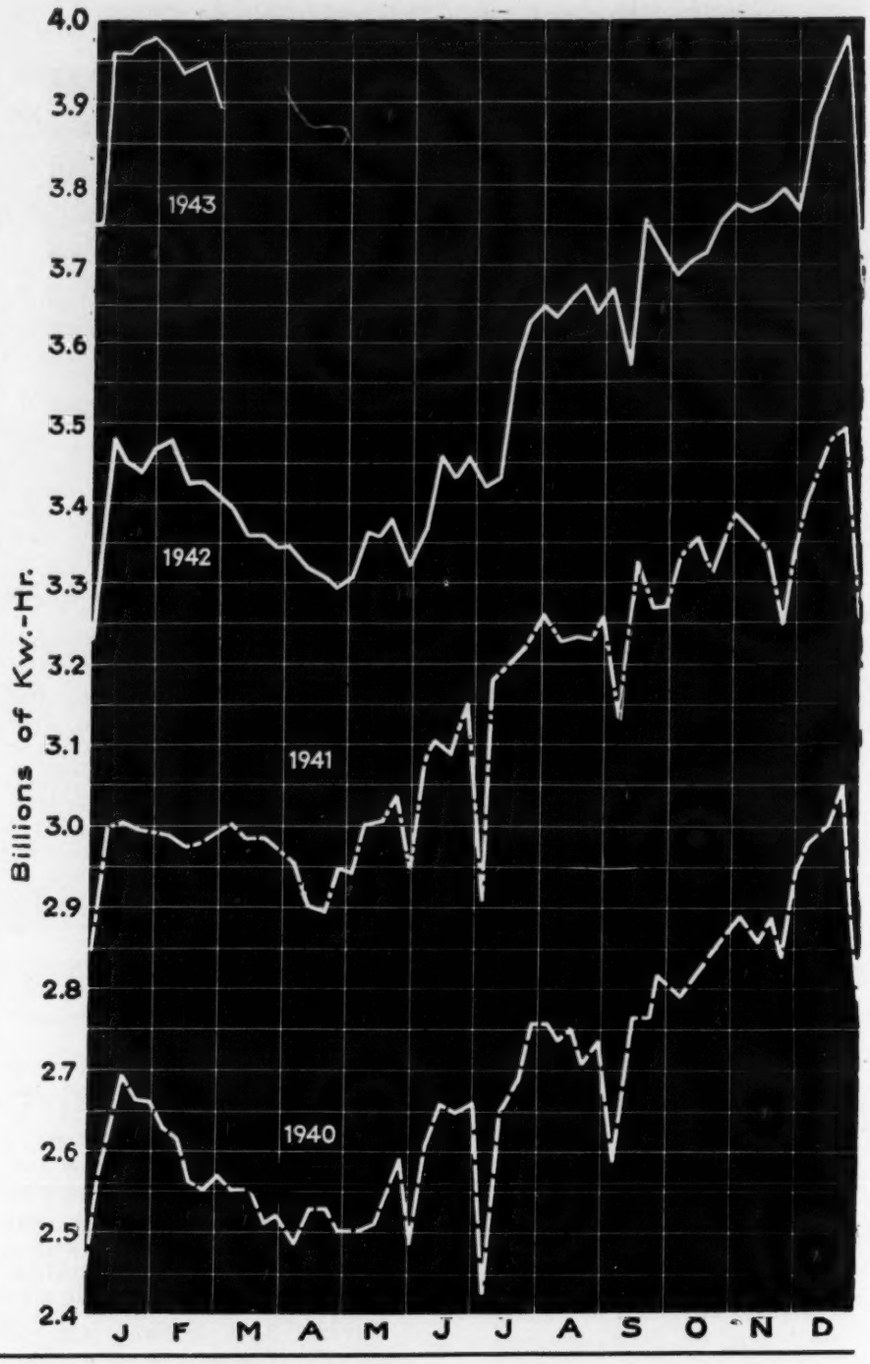
All the major geographic regions of the country registered percentage losses from the previous week, compared to the 1942 week, except the Pacific Coast region, which increased its lead from 30.6 percent to 31.0 percent—a commanding lead over the gains registered elsewhere in the country. Biggest drop from the previous week came in the Rocky Mountain area—from 14.8 percent for the February 20 week to 9.4 percent for the latest week.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Feb. 27	3,893	Feb. 28	3,410	Mar. 1	2,993
Feb. 20	3,949	Feb. 21	3,423	Feb. 22	2,985
Feb. 13	3,940	Feb. 14	3,422	Feb. 15	2,976
Feb. 6	3,960	Feb. 7	3,475	Feb. 8	2,989
Jan. 30	3,977	Jan. 31	3,468	Feb. 1	2,994
Jan. 23	3,974	Jan. 24	3,440	Jan. 25	2,996
Jan. 16	3,952	Jan. 17	3,450	Jan. 18	3,013
Jan. 9	3,952	Jan. 10	3,472	Jan. 11	3,002
Jan. 2	3,780	Jan. 3	3,289	Jan. 4	2,816
1942		1941		1940	
Dec. 26	3,656	Dec. 27	3,234	Dec. 28	2,757

Percent Change from Previous Year

	Week Ending		
	Feb. 27	Feb. 20	Feb. 13
New England	+ 4.5	+ 4.6	+ 6.0
Mid-Atlantic	+ 8.4	+ 9.2	+ 8.6
Central Industrial	+11.8	+13.1	+12.4
West Central	+12.8	+13.7	+13.0
Southern States	+17.7	+19.7	+19.3
Rocky Mountain	+ 9.4	+14.8	+14.2
Pacific Coast	+31.0	+30.6	+32.2
Total United States...	+14.2	+15.3	+15.1



Average Daily Output Hits New Record High

The average daily production of electric energy for public use for January was 606,461,000 kw.-hr., again establishing a new record high, according to reports filed with the Federal Power Commission. This is an increase of 0.5 percent when compared with the average daily production during the month of December, 1942. Production of electric energy for public use during January totaled 17,344,776,000 kw.-hr., an increase of 13.0 percent when compared with January, 1942. Production by water power amounted to 6,386,290,000 kw.-hr., or 36.8 percent of the total output for public use.

•

Some Refrigerators May Be "Unfrozen"

Some of the nearly 500,000 domestic mechanical refrigerators which have been frozen for government use for the past year may be released to domestic consumers.

Members of the Domestic Mechanical Refrigerator Industry Advisory Committee met recently with WPB officials to discuss distributing the remaining units. If estimates of governmental requirements are revised downward, some of the refrigerators will be available for consumers requiring replacements or newly established households.

•

Utility Fuel Consumption

Coal consumption by electric power plants was 6,216,460 tons in January, which is a decrease of 183,706 tons from the December, 1942, consumption and an increase of 74,332 tons, or 1.2 percent, above the consumption for January, 1942, the Federal Power Commission reports.

Utility Stocks Lose Ground; Bonds Firm

Electric light and power stock prices dropped slightly during the past week, the "Electrical World" index dipping to 23.0 from 23.2 the previous week; last year, 19.3. Bonds remained at 104.9; last year, 104.2

Utility Financing Off 50 Percent

Utility financing fell off more than 50 percent in 1942, the Securities and Exchange Commission disclosed last week.

In an analysis prepared by the public utilities division of the commission, it was recorded that 58 issues of such securities with a total principal amount of $376,979,353 were publicly offered or privately sold during the year, compared to 108 issues amounting to $840,734,549 in 1941. In the previous year 86 issues were offered with a total principal amount of $881,247,251.

Offerings last year brought the eight year total of such issues to 597 amounting to $7,098,538,334.

Of the 1942 offerings, 28 were bond issues totalling $241,264,000; 3 were debenture issues amounting to $16,250,000; 18 were note issues amounting to $75,734,448 and 7 preferred stock issues amounting to $43,423,000.

•

United to Buy Two Iowa Companies

Negotiations have been completed and SEC approval is to be sought for the purchase by the United Light & Power Co. system of the control of the Des Moines Electric Light Co. and the Iowa Power & Light Co. from the Illinois Iowa Power Co., it was revealed recently. The properties will be bought by the Continental Gas & Electric Corp., a United subsidiary, for $15,220,000, which includes a substantial amount of senior securities of the companies in addition to their entire common stock.

The transaction, considered a major step in the integration program of United to bring it into compliance with the Holding Company Act, will bring certain Iowa properties, already owned by United, into a combined operation with the new units under the name Iowa Power & Light Co. Assets of the merged companies will be in excess of $48,000,000.

FINANCIAL BRIEFS

AMERICAN POWER & LIGHT CO., an Electric Bond & Share subsidiary, has received permission from the SEC to spend not in excess of $10,000,000 in cash to acquire, by open market purchases, part of its outstanding gold debenture bonds, 6 percent series, due 2016, and its assumed Southwestern Light & Power Co. 6 percent gold debenture bonds, series A, due 2028.

ELECTRIC BOND & SHARE CO. has asked SEC permission to use $15,000,000 of its surplus cash for retirement of its preferred stocks to effect savings in preferred dividend requirements. Included in the sum applied for is $3,000,000 over which the SEC reserved jurisdiction in a previous order. Already the commission has authorized the expenditure of $7,000,000, which retired $12,673,000 of preferred stock with a saving of $729,000 in annual dividends.

THE SEC HAS ORDERED A HEARING for March 26 to receive further evidence as to whether the North American Co. may retain the gas business conducted by its subsidiary, St. Louis County Gas Co., in addition to the integrated electric system of Union Electric Co. of Missouri. The commission also permitted Union Electric to purchase for $45 per share 8,793 additional shares of Iowa Union Electric Co. common stock. Iowa Union will use the proceeds to retire $700,000 worth of outstanding bonds.

THE SEC HAS ORDERED a hearing for March 10 on the proposal of six Wisconsin men—Walter M. Jensen, John A. Larson and Frank N., Oscar G., Fred E. and Carl Dahlberg—to purchase from American Utilities Service Corp. all of the 2,000 shares of the issued and outstanding common stock of Northwestern Wisconsin Electric Co. for an aggregate purchase price of $265,000 in cash. The stock has a par value of $100 per share.

E. M. GILBERT ENGINEERING CORP. has received SEC permission to merge into Associated Utilities Corp., the parent concern and owner of all its outstanding capital stock.

TRI-CITY UTILITIES CO., an Associated Electric Co. subsidiary, formed to liquidate the remaining properties of the former Kentucky-Tennessee Light & Power Co., has amended its charter to provide for decreasing capital stock from $3,000,000 to $2,200,000.

THE SEC HAS TAKEN UNDER ADVISEMENT objections raised by a group of preferred-stock holders of Puget Sound Power & Light Co. to the terms of a proposed plan of recapitalization of the company. The stockholders contend that the repayment of bank loans proposed in the plan would utilize cash that otherwise would be employed in the payment of dividends. The refinancing plan has been modified to substitute $6,500,000 of 3⅛ percent 5-year bank loans in place of $8,000,000 of 9-year debentures. Plans to sell $52,000,000 of first mortgage bonds remain unchanged.

Utility Reports

	Net Income 1942	1941
*Arkansas Power & Light	†$1,235,774	$2,025,344
*Associated Gas & Electric and subs	8,660,673	8,440,141
*Boston Edison	5,688,106	6,006,126
*Carolina Power & Light	†2,290,094	3,000,542
*Cleveland Elec. Illuminating	6,134,260	7,056,585
*Commonwealth Edison and subs	22,108,102	26,747,901
*Consolidated Edison of N. Y. and subs	†31,489,524	33,920,911
*Dallas Power & Light	†1,487,808	1,925,466
*Idaho Power	†1,334,212	1,300,825
*Louisiana Power & Light	†1,198,891	1,198,750
*Minnesota Power & Light	†1,585,276	1,685,695
*New Orleans Public Serv.	†2,375,488	2,659,474
*Pennsylvania Power & Light	†5,448,413	7,049,420
*Utah Power & Light and subs	†1,773,771	1,963,634

*Twelve months ended December 31.
†Preliminary.

Oil-drenched and salt-encrusted, PYRANOL TRANSFORMERS COME THROUGH UNHARMED

Three Pyranol transformers were in operation on a large tanker when it was torpedoed off the Atlantic coast. For days they lay submerged in oil and salt water, until what was left of the tanker was salvaged. When the ship finally reached dry dock, the transformers were tested and found to be in as good working condition as the day they were installed.*

IT'S HARD to find an application where Pyranol transformers won't fill the bill. The high dielectric strength which they have in common with other liquid-filled transformers makes it easy for them to withstand the effects of lightning and of voltage surges from switching operations.

Install Pyranol Transformers Right Where You Need Them

Location doesn't matter; you can install Pyranol transformers underground, on an overhead platform, on the roof, on the factory floor, indoors or outdoors—or install them indoors this year and move them outdoors next year if your needs change. The pressure-tight tank protects vital parts from the effects of dust, dirt, and atmospheric moisture—as well as from oil and salt water.

Maintenance Cost Is Low

Pyranol, the synthetic, noninflammable liquid with which these transformers are filled, is nonsludging—maintenance is negligible. Tests made recently show that the Pyranol in the first transformers of this type, installed more than ten years ago, is still in its original condition.

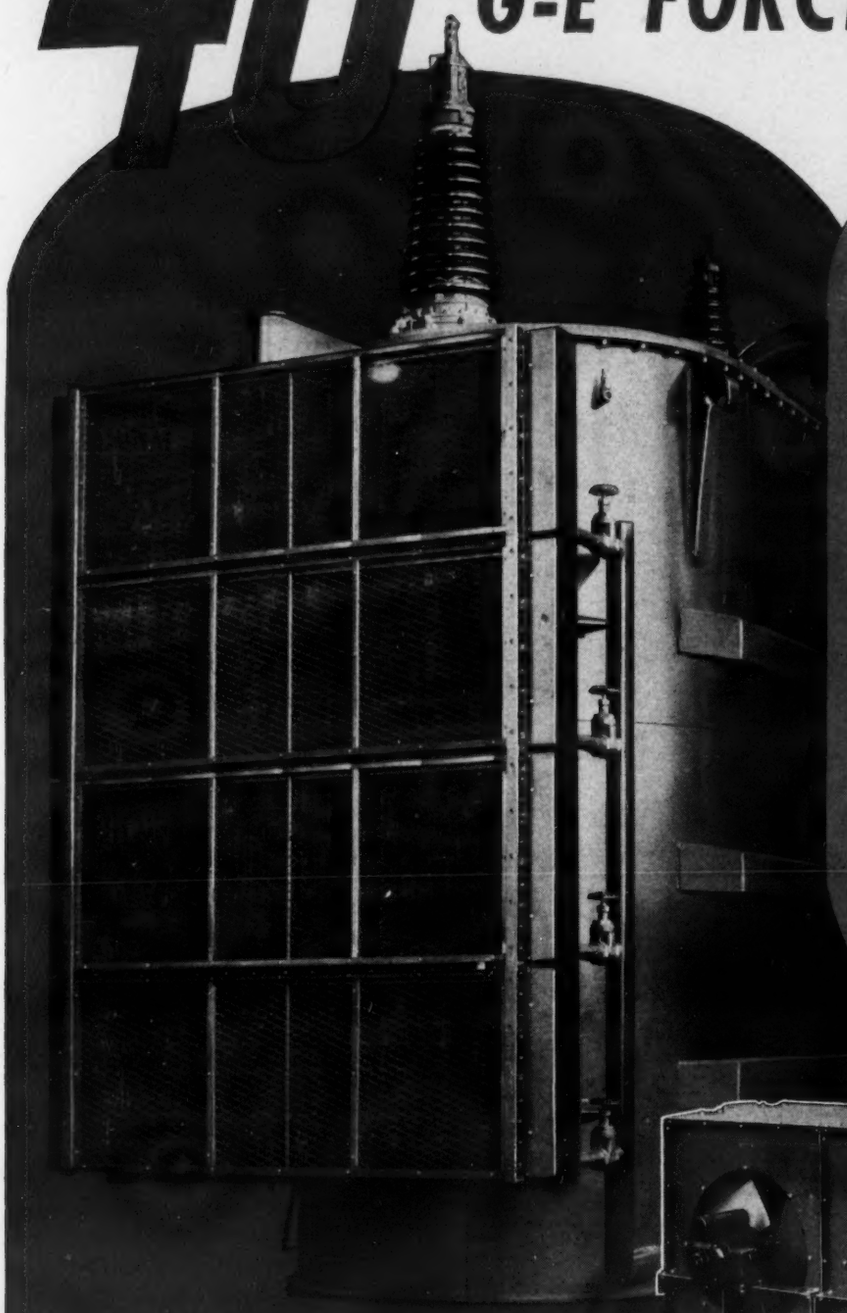
For further information about Pyranol transformers, call your G-E representative today. He'll be glad to help you. *General Electric Company, Schenectady, New York.*

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

40% Less Material..

G-E FORCED COOLING



G-E forced-cooled (forced-oil, forced-air-cooled) transformer. Single-phase, 3-winding, rated 40,000 kva, 138,000 volts, 60 cycles

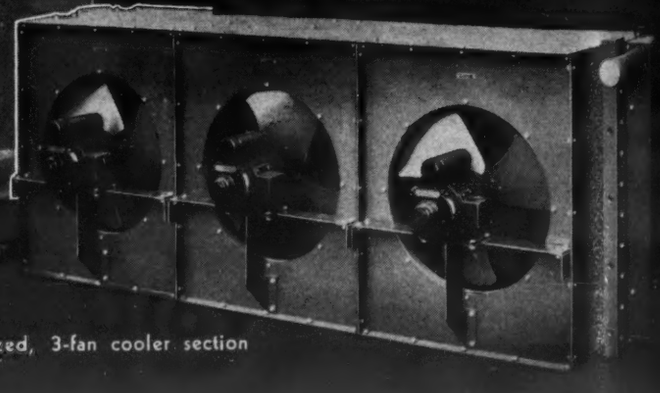
Here's How Forced Cooling Works

IN the G-E forced-oil, forced-air-cooled transformer the oil is pumped through a fan-cooled, fin-type cooler.

The cooler is made up of one or more standardized units, the number depending upon the amount of heat to be dissipated. Each unit is provided with individual shut-off valves to permit its removal without shutting down the remainder of the cooler.

An all-weather fan, with highly efficient, aphonic blades, and a Thermo-Tector switch protect the motor for efficient and safe operation.

The oil pump and motor are immersed in the circulated transformer oil, thus eliminating the need for a stuffing box.



Rear view of standardized, 3-fan cooler section

nd a Better Power Transformer Brings You These Benefits

UP TO 40% LESS WEIGHT — Reduces first cost. Saves expense, both in the foundation and in handling.
Doubles the kva that can be shipped assembled where *weight* is the limiting factor.

UP TO 50% LESS VOLUME — Permits smaller station structures.
Triples the kva that can be shipped assembled where *size* is the limiting factor.

SHIPPED ASSEMBLED — Saves time and cost when installing.
Reduces the possibility of error and contamination from field assembly.
Permits metal-sealing of most oil joints, reducing the number of gaskets.

These benefits are obtained while maintaining the electrical safety factors, short-circuit strength, and full life expectancy.

Positive liquid-tight pump—no stuffing box, no gaskets, no leaks, no maintenance

FOR INCREASING CAPACITY, TOO

Forced-air, forced-oil coolers can also be used to increase the capacity of power transformers already installed by augmenting—or completely replacing—self-cooled, air-pressure-cooled, or water-cooled systems.

Your G-E representative will be glad to obtain for you detailed recommendations covering G-E forced-cooled power transformers for your requirements. Ask for Bulletin GEA-3934. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

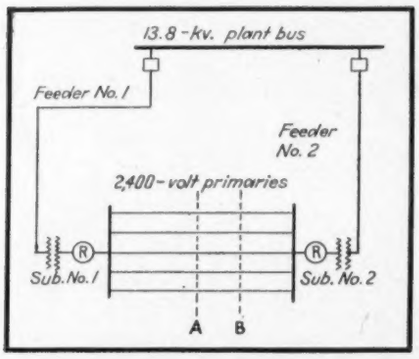
401-11-6186

HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

Shifting Load on Primary Networks

By B. E. ELLSWORTH
Electrical Engineer, North Platte, Neb.

Two generators connected to a plant bus are made to shift kilowatt load from one to the other by a change of speed or frequency, and only reactive kva. is shifted by a change of voltage. In the case, however, of a regulated primary network fed from two points the kilowatt load can be changed or transferred from one substation to the other by changing the voltage setting of the regulators at the substations.



ON A REGULATED primary network a change in regulator voltage setting is necessary to transfer load from one substation to another

Assume a primary network and load fed by two 13,800-volt feeders originating at a single plant bus (see sketch). If the impedance of the feeders is identical, load is evenly distributed along the primaries and the regulators or tap-changing transformers are set for the same voltage, then the load will be divided equally between them. With this condition prevailing load current will be zero at point "A" or the midpoint of each primary, since the impedance each way to the plant bus will be the same.

If regulator on substation No. 1 is now set to keep a higher voltage than the regulator at substation No. 2, then the load carried by the two feeders will not be the same. Not only will some low power factor circulating current flow in the loop but the kilowatt load current will also be changed.

As effective impedance varies inversely as the square of the voltage, the primaries extending from A to substation No. 1 will have less effective impedance than those from point A to substation No. 2.

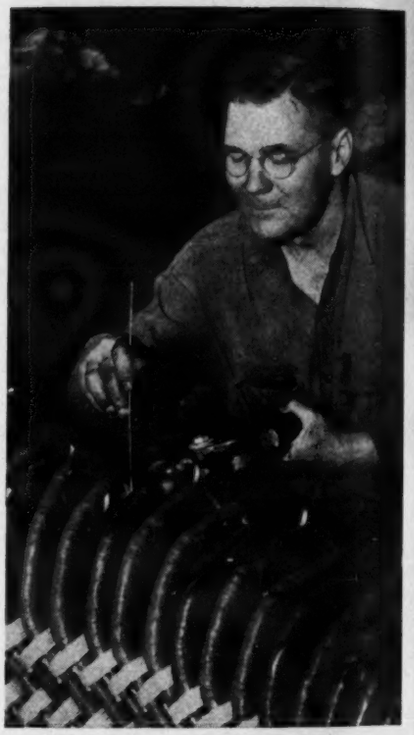
The point of no load current will therefore shift from point A to point B, which is the new point where impedance both ways to the plant bus will be the same. The kw. load on the primaries between points A and B will be taken from substation No. 2 and carried by substation No. 1. In this particular case the change of a.c. voltage does shift kilowatt load.

•

Brazing Joints Saves Solder

By HARRY MATTHEWS
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

In searching for ways to save pure tin used in soldering coil and connections brazing was considered as a possible solution for the problem. This method was found to be completely satisfactory and resulted in a job of better appearance and a joint of much higher electrical conductivity. The only equipment needed is a set of carbon-tipped brazing tongs and a suitable welding transformer. Conventional brazing rod suitable for joining copper is used. The accompanying illustration shows the relative size of the tongs and the ease with which they can be used in small spaces.



BRAZING TONGS used for joining operation formerly done by soldering

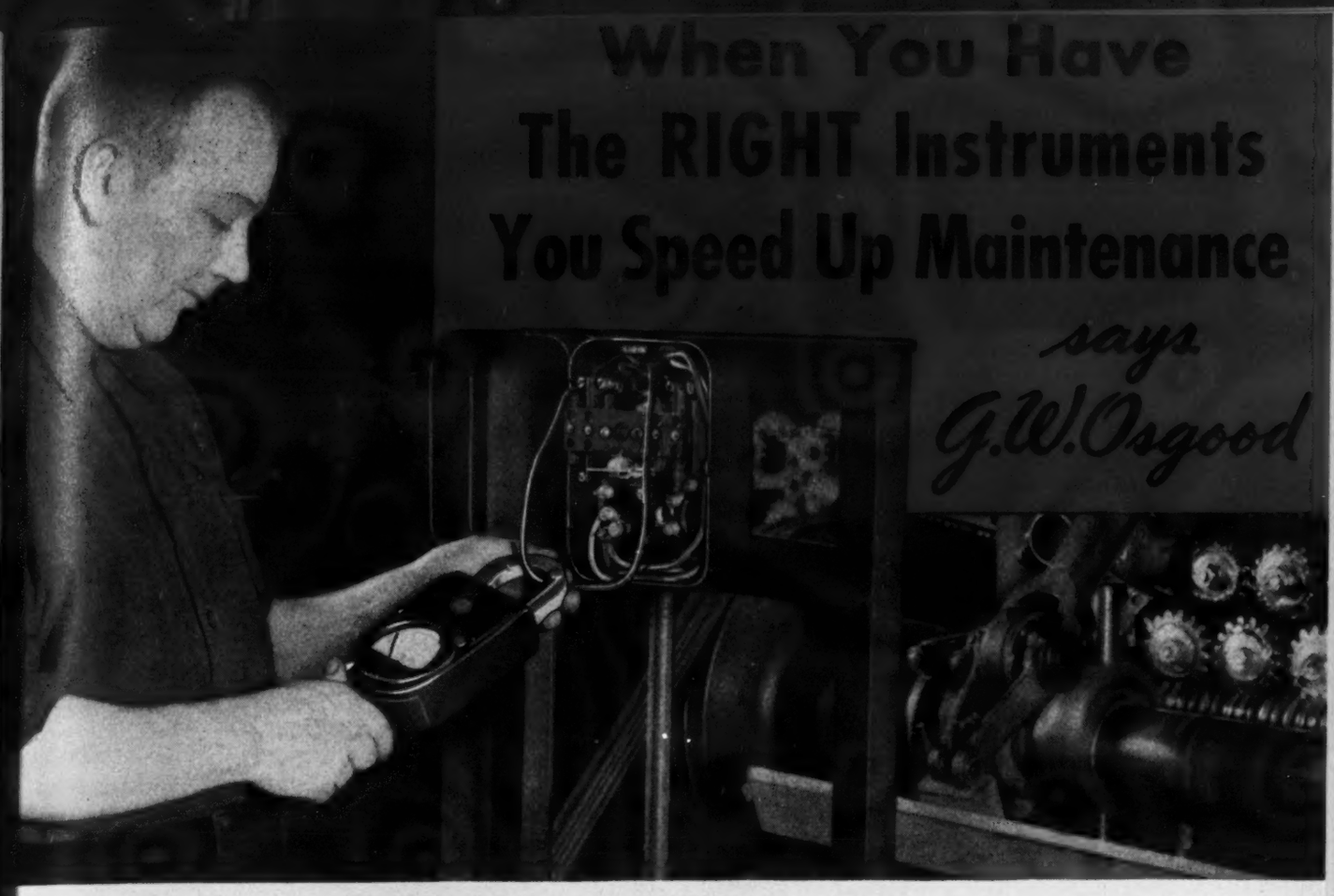
•

Dented Standards Ironed Out on Arbor

A metal arbor conforming to the flutings on the stem of ornamental street-light standards is used by the Toledo Edison Company, Toledo, Ohio, to remove dents inflicted by

When You Have The RIGHT Instruments You Speed Up Maintenance

says G. W. Osgood



WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?

AK-1

A-C HOOK-ON VOLT-AMMETER. The handiest of instruments for quick load checks—no cutting conductors or interrupting service. Measures volts also. Bulletin GEA-2950.

AP-9

MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C). Accurate within ¾ of one per cent. Very portable—size only 2½ by 4¾ by 6½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

AS-5

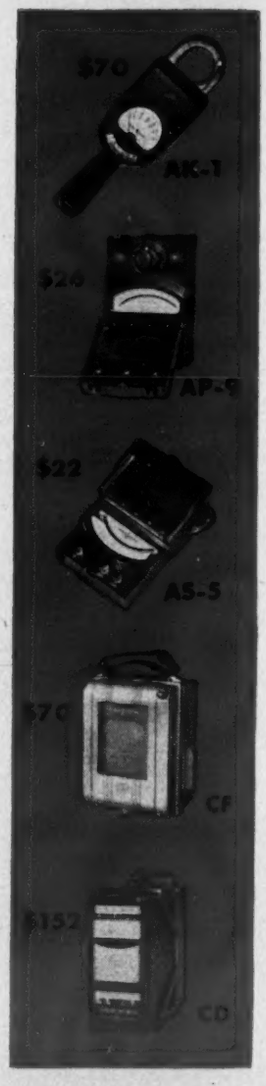
POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C). Accurate within one per cent. Slips easily into a coat pocket—size 2 by 3½ by 5½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

CF

INKLESS RECORDER, PORTABLE. An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-3187.

CD

INK RECORDER, PORTABLE AND SWITCHBOARD. Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.



"**FOR QUICK LOAD CHECKS,** we find the General Electric hook-on volt-ammeter the handiest of all instruments. But, it is not a cure-all. There are times when we use an indicating instrument that has an accuracy even higher than the ±3 per cent of the AK-1.

"For still other work, we need a chart record of current or voltage taken during an entire cycle of operation of a single machine, or of an entire section of the plant—that's when we use a recorder.

"Having the *right* instruments available speeds up our preventive maintenance work."

Those are the words of G. W. Osgood, Electrical Department, Merrimac Hat Co., Amesbury, Mass.

Don't Handicap Green Hands by a Lack of Instruments

When experienced maintenance men like Mr. Osgood say it's important to have the *right* instruments, we can imagine how handicapped inexperienced men must be without them.

Still, you don't need a roomful of instruments. The five shown here will do 90 per cent of your testing work (prices are for estimating only). If you would like more information about them, ask the nearest G-E office for the bulletins listed. If these instruments won't answer, tell us what you need. We may have a standard instrument that will do the job. *General Electric, Schenectady, N. Y.*

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

GENERAL ELECTRIC

660-28-4200

erratic autoists in the light metal of certain types of standards.

Until this arbor was devised it was difficult and frequently impossible to reclaim the tapered and fluted stem of these fixtures because they were of light, easily dented metal, which because of the flutings was difficult to re-form to its original contour. Cast bases are easily welded together if not too badly shattered.

The arbor used in the Toledo shop is a casting made from a plaster-of-paris pattern. It is slipped inside the damaged stem and used as an anvil in pounding out dents. Mold from which the arbor was cast was made by pouring an amount of plaster-of-paris into the lower section of the stem of a new standard and allowing it to dry. When the plaster dried it was easily slipped out of the stem, giving an exact pattern of the flutings.

•

Cold Cathode Tubes Used on Relays—III

By E. C. SCHURCH
Senior Electrical Engineer, Electrical Design Section, Bureau of Reclamation, Denver, Colo.

A differential-type relay for protection of generators, buses and transformers has been developed which uses cold cathode gas-filled tubes as a fault-detecting agent. The circuit is shown in the accompanying diagram.

Transformer T_1 is energized by the difference current from the two sets of current transformers, and, when difference current of sufficient magnitude flows, the relay operates in the same manner as described for the overcurrent relay (ELECTRICAL WORLD, February 20, 1943, page 82).

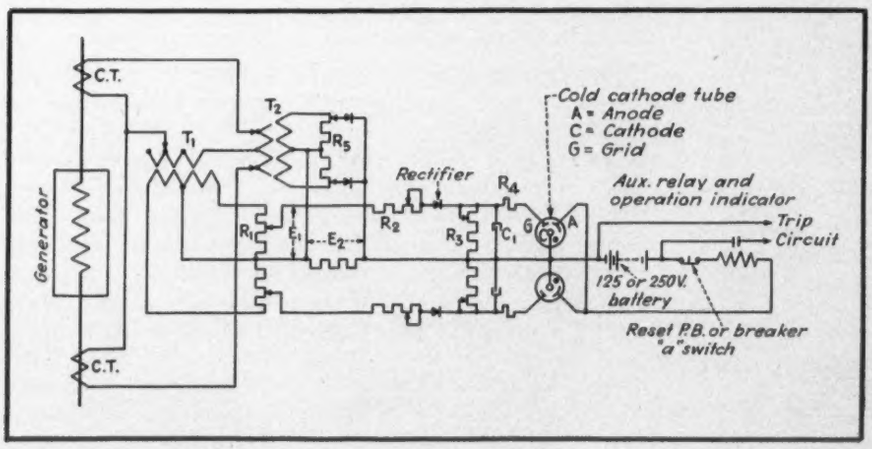
A ratio differential effect is obtained by biasing the voltage E_1 produced by the difference current by a voltage E_2 which is proportional to the through current. The operating characteristics are similar to those obtained with an induction-type ratio differential relay.

A directional ground relay will be described in a subsequent article in this series.

•

More Lead for Bullets

Every day about 400 meter seals weighing about 0.1 oz. each are collected by some 50 Boston Edison meter and accessory testers on customers' premises and brought back to the general service buildings for deposit in the so-called "bullet pile." Eight hundred of these seals when molded form a 5-lb. ingot of lead, and thus reduce the draft upon the country's metal stock, releasing worthwhile quantities for ammunition production in the war effort.



CONNECTIONS for single-phase ratio differential relay

Trebling Air Supply with 20% Power Rise

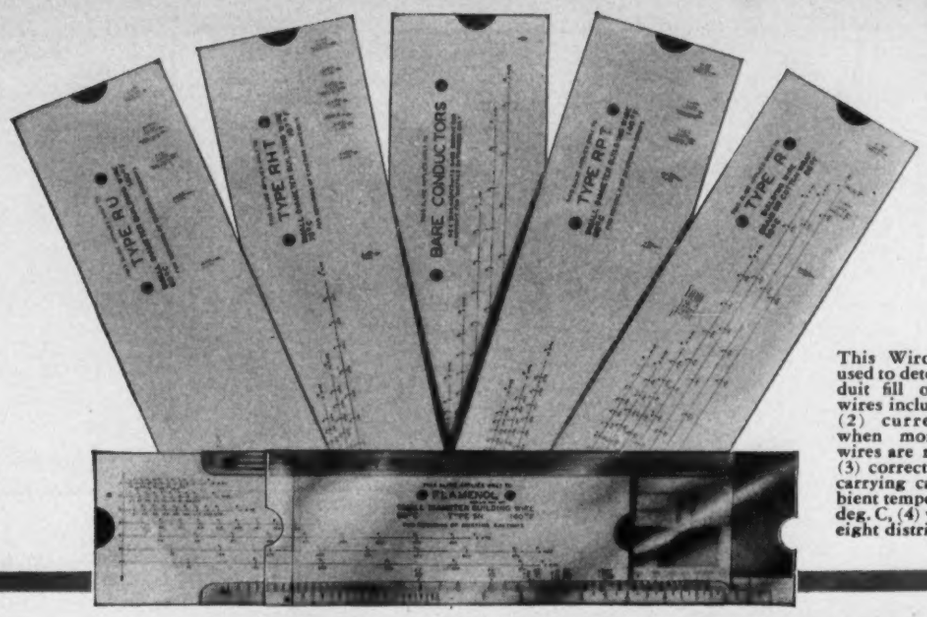
By JOHN CASSIE
Installation Analysis Department, B. F. Sturtevant Co., Hyde Park, Mass.

In a steam plant recently investigated on account of a complaint of inadequate air supply from a fan to a heat exchanger installation the importance of guarding against leakage in duct systems and of avoiding spin or other turbulence near a fan inlet was emphasized. The original installation is shown in Fig. 1. During operation cold air is drawn from the atmosphere into the system at *I*, the air volume being measured at orifice plate *O*. From here the air eventually split into two paths, only one being shown, since the important portions are symmetrical about the centerline *CC*. This path was from *B* through *D* to *E*, where the cold air entered the first pass of tubes of the exchanger, leaving at *F* and entering the second pass at *G*. From the exchanger the highly heated air passed diagonally downward to the inlet box to the fan eye *J*, thence being discharged through *K* for use. The hot gases flowed transversely downward around the tubes *T*.

The inquiry required several tests. The duty for which the fan was selected is shown in the curve, Fig. 2, at 100 percent volume, pressure and horsepower. The curve is based on cold air flowing through the entire system, as this was the condition under which the investigation was conducted.

First Test

In the first test the orifice method indicated only 40 percent of the specified air volume entering at *I*. Simultaneously a pitot tube traverse in the fan discharge duct indicated more than 94 percent of the specified volume leaving the system. Results of this test appear in Fig. 2 at *M'*, *M* and *N*. The second test was run to resolve doubts as to the possibility of a leakage of this magnitude. The set-up was as shown in Fig. 1 except that the intended system inlet *I* was blanked shut. As expected, no flow was indicated at *O*, but a pitot tube in the traverse of duct *K* showed about 80 percent of the specified volume flowing from the fan and system point *P* on curve, Fig. 2. Considering the "leakage opening" as a fixed orifice, this new and larger leakage volume



This Wirometer can be used to determine: (1) conduit fill of all building wires including Type SN; (2) current capacities when more than three wires are run in conduit; (3) corrections in current-carrying capacity for ambient temperatures over 30 deg. C, (4) voltage drop for eight distribution systems.

FREE G-E WIROMETERS

For Computing Wiring Problems

Power salesmen, engineers and layout men will find the G-E Wirometer helpful in selecting the right wire quickly when making rough layouts. It is pocket size—8 inches long and 2⅜ inches wide. Six interchangeable slides are provided for making calculations on conduit fill of all building wires, current capacities and voltage drop. While this G-E Wirometer is not a cure-all for all wiring problems, it will help save time and simplify design procedure.

Mail the Coupon Today for a G-E Wirometer

General Electric Company
Section W331-9
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me free: ( ) G-E Wirometer; ( ) information on Flamenol Building Wire.

Name .....

Address .....

City ..... State .....

FLAMENOL* Building Wire

This G-E Type SN small diameter building wire has synthetic insulation that is superaging, resistant to heat, oils, acids, alkalies and moisture and has high dielectric and mechanical strength.

Reg. U. S. Pat. Off.

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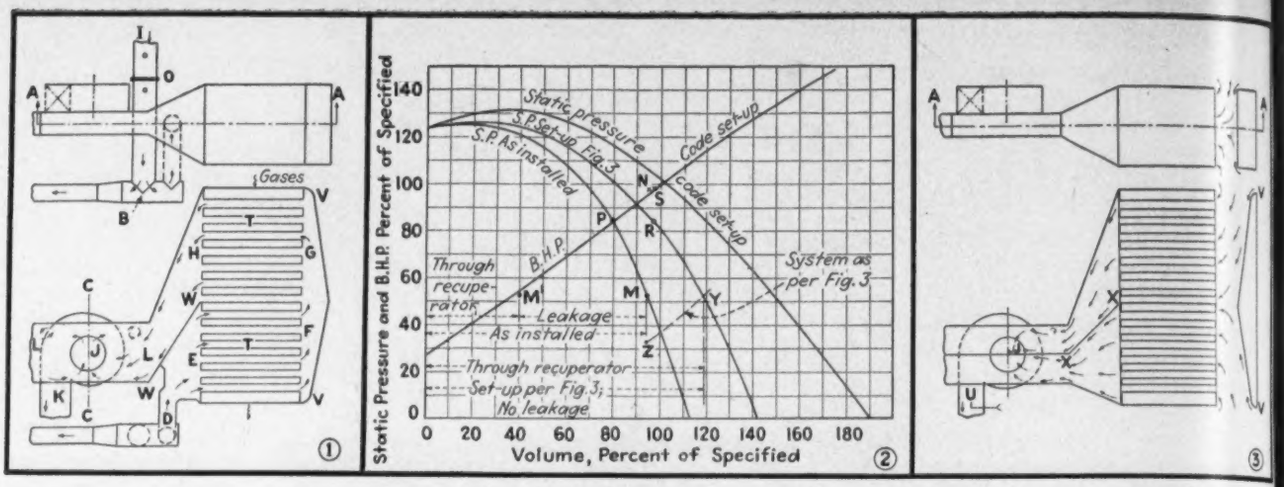


FIG. 1—Original layout of fan, ductwork and heat exchanger where deficiency of air supply through leakage and turbulence occurred. FIG. 2—Relationships between air volume and power consumed before and after corrective measures were applied. FIG. 3—Layout of equipment after effecting improvements

appeared in line with the first test results when due allowance was made for the increased suction of the second test due to blanking off *I*. From the existing volume and suction the leakage area was computed. This looked impossibly large, being equivalent to the opening of an 11.6-in. diameter circle. No such large hole was at once apparent, but with a total peripheral length of about 67 ft. at joints *EH* only $\frac{1}{8}$-in. crack width is needed to account for the calculated area. This area was found during internal inspection of the system.

Third Test

This inspection was made possible by the removal of transition pieces, one being shown at *LH* (Fig. 1). With these pieces omitted, a third test was run. Pitot tube traverse showed about 97 percent of specified volume, with pressure now as shown at *R* and the horsepower at *S*, Fig. 2. This meant that the pressure at volume *M* had risen about 66 percent with no change in horsepower from the curve noted as "S.P.—as installed," and also that the fan efficiency had increased 66 percent at that volume. This was due to the leakage and spin elimination. The curve shows that point *R* still does not lie on the predicted curve labeled "static pressure —code set-up," and for the following reasons, in part: (1) Inlet box, *LL* not properly proportioned for this size and design of fan; (2) no bell-shaped flares were in place at *L* to avoid contraction of entering air stream, so that (1) is further emphasized; (3) Pitot tube readings were necessarily taken at *K*, which is so close to the fan discharge that full available conversion of velocity pressure into static pressure has not yet been effected to the extent that it would be on a test code set-up, and upon which the predicted curve was based.

The following steps were decided upon as a result of the tests, to improve the original layout:

(a) Elimination of piping *IBDE* and substitution of permanent pitot tube *U*. This allowed measurement of the flow handled, yet did away with the pressure losses of the removed piping.

(b) Rotation of the end cap turn, *VV*, to the new position shown in Fig. 3. This allows air to enter the system between *VV* and the tube bundles. The tube bundles now being in parallel instead of in series, greatly lowers the resistance through them with a consequent reduction of the suction at the leaving side of the exchanger—hence a marked reduction in the tendency for leakage.

(c) Better means of preventing leakage were taken.

(d) Elimination of the plate *WW* and substitution of central plate *JXX*. This plate assures equal division of air supply to upper and lower halves of the fan eye *J*, which is extremely important.

With the layout of Fig. 3 it can be estimated from the tests that the volume-pressure attainable lies along a curve noted "system as per Fig. 3," *Z* being the estimated resistance for volume *M*. The operating point will also lie on the curve passing through *R*. Since the attainable volume-pressure point lies on each of the curves just mentioned, it must be at their intersection *Y*. This means 119 percent of specified volume handled through the exchanger with all leakage and spin eliminated. This is about three times the volume of test No. 1.

In building ductwork for as high a temperature as in this case, it is impracticable to use much more guiding by steel plates than is indicated at *XX*, Fig. 3. It is practically impossible to maintain all joints fully tight. The expected volume, therefore, would be somewhat less than at *Y*. Despite this, more than 100 percent of specified volume is considered regularly attainable, as against 40 percent in the original layout. Omission of the inlet piping reduced floor space needs and also saves money and critical material.

•

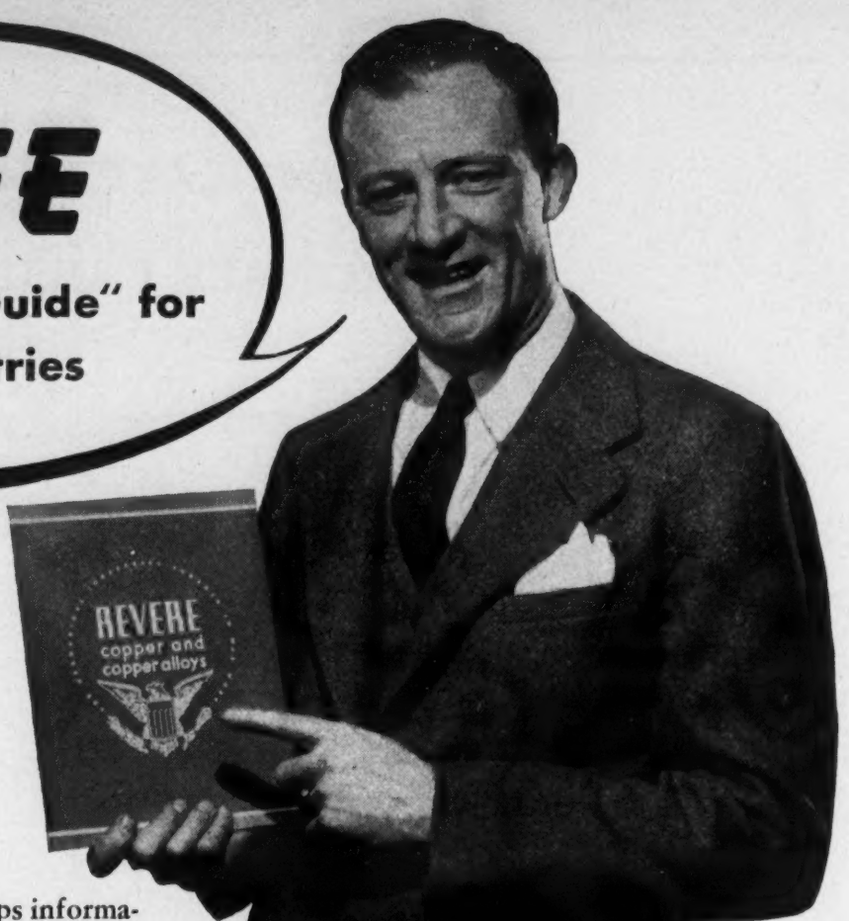
Cooling Relieves Load-Taxed Transformer

Portable transformer cooling fans stood the Illinois-Iowa Power Company in good stead last summer when one of the 5,000-kva. transformers in two parallel banks of wye-connected units serving a 29,000-kw. load failed, throwing a load of about 10,000 kva. on the remaining transformer in the affected phase. Six $\frac{3}{4}$-hp. wing-type fans, each with a capacity of 30,000 c.f.m., were directed against the remaining unit during a three- to four-week period while the faulted unit was being repaired.

Ambient temperature during this period was between 80 and 90 deg. F. However, it is reported that the fans kept the oil temperature in the overloaded transformer at approximately 65 deg., while temperature of the oil in the other self-cooled units of the bank was about 70 deg. C. Load factor on the bank was about 40 percent.

FREE

New "Copper Guide" for war industries



Here is a book that puts at your fingertips information about Revere copper and copper alloys that users most frequently need. That answers most of the questions asked of Revere by the mechanical industries engaged in war work! Compiled especially for your use today. And organized like a handbook for easy reference.

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COMPILATION OF

TRANSFORMER FAILURE DATA

By the use of three report forms one utility has a record of what transpires after a transformer fails until it is tested for extent of damage.

A "Transformer Failure Report" is initiated (first six lines) and other data are added when a "Transformer Inspection Report" and "Lightning Arrester Failure Report" are received.

TRANSFORMER FAILURE REPORT

_____ COMPANY No. _____

Date _____ Time _____ M. Weather _____

Location _____

Co. No. _____ Size _____ Make _____ Serial No. _____ Phase _____

Voltage _____ Low Oil? _____ Flash-Over? _____ Cond. Leads _____

Apparent Cause of Failure _____

Type of Old Fuse Box _____ Fuse _____ Size _____

Cond. " " " " _____ Replaced With _____

New Fuse _____ Size _____

Lightning Arresters:

Type _____ Condition _____

Replaced? _____ Type of New Arrester _____

Condition of Ground Connections _____

Transformer Replaced With: Size _____ Co. No. _____ Serial No. _____ Make _____

Remarks: _____

Transformer Replaced By — General Foreman

Dept. Head

Ground Conditions:

Resistance Lgt. Ar. Ground _____ Secondary _____ Date _____

Remarks: _____

Ground Treatment: Method _____ Date _____

Resistance After Treatment: L.A. _____ Secondary _____

Original Tests By — Dept. Head

Rechecked By — Recorded By

Report of Damaged Transformer Test

Date _____

Make _____ Size _____ Serial No. _____ Date Removed from Line _____

Condition Revealed By Test: _____

Tested By — Engineer in Charge

Recorded By — Dept. Head

TRANSFORMER INSPECTION REPORT

_____ COMPANY

Inspection No. _____

Date _____

Location _____

_____ Pole No. _____

Company No. _____ Serial No. _____ Kva _____

Voltage: Primary _____ Secondary _____

State Condition of all Parts and Equipment Listed Below:

1. Leads _____
2. Oil _____
3. Bushings _____
4. Connections _____
5. Fuse Box _____ Type _____
6. Fuses _____ Type _____ Size _____

New Fuse Used: Type _____ Size _____

7. Lightning Arresters: Type _____ Condition _____

New Lgt. Ar. Used: Type _____

8. Condition of Ground Connections: _____

Remarks: _____

Inspector — General Foreman

Dept. Head

LIGHTNING ARRESTER FAILURE REPORT

_____ Company

Date _____

Make _____ Location _____

Date Inst. _____ Line Voltage _____ Transf. Co. No. _____

Type of Lgt. Ar. _____ Ground Resistance Lgt. Ar. _____ Secondary _____

Reasons for Investigation _____

Probable Cause of Failure _____

Condition of Arrester When Removed _____

Remarks: _____

Replaced With: Make _____ Date _____

Ground Resistance Lgt. Ar. _____ Secondary _____

Remarks: _____

Investigator — Gen. Foreman or Dept. Head

Investigator — Superintendent

PHILCO

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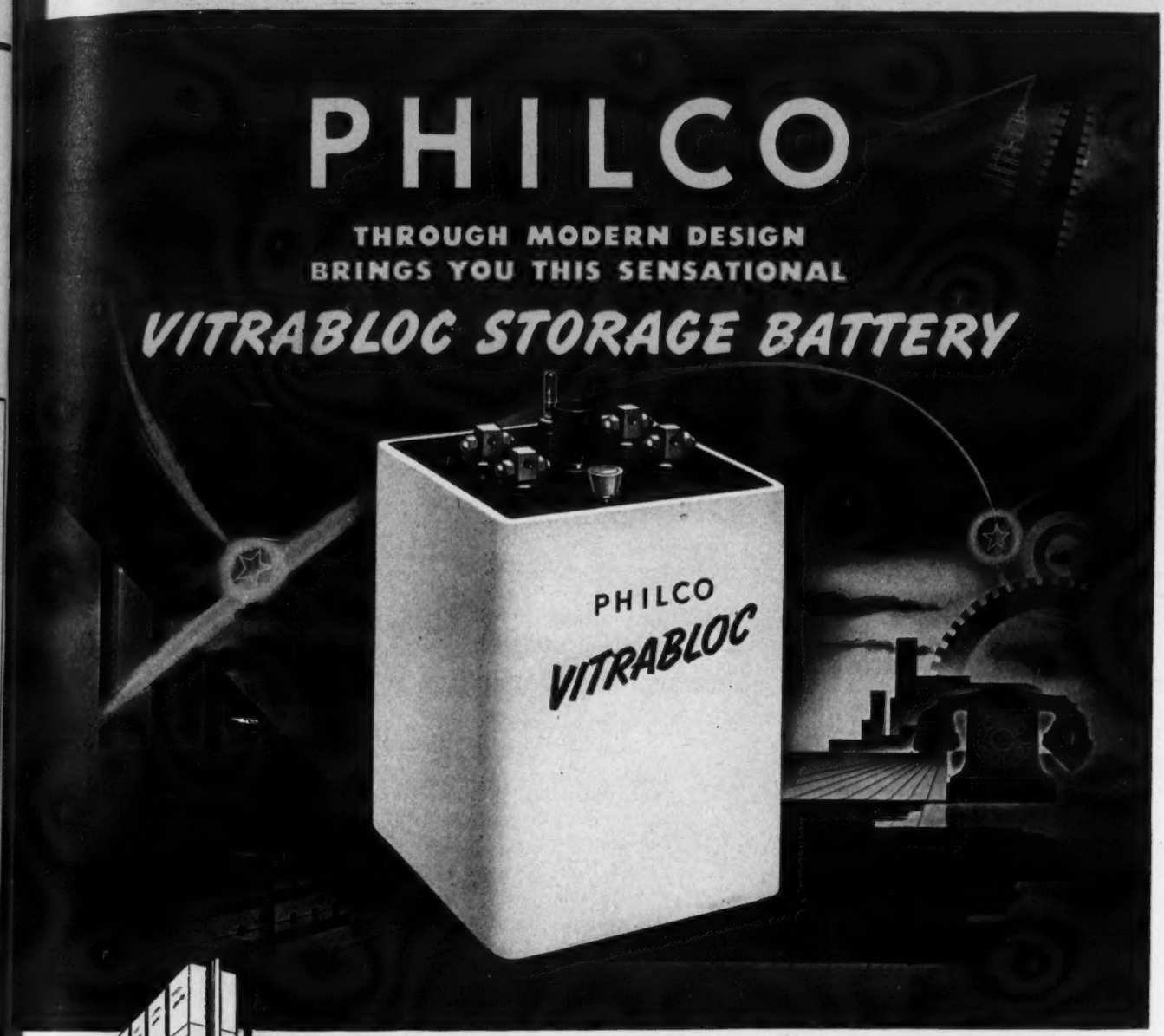
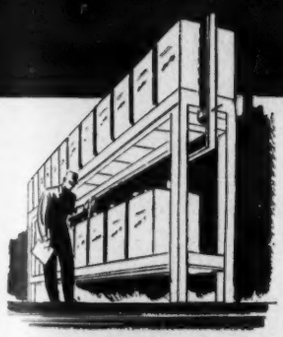
BRINGS YOU THIS SENSATIONAL

VITRABLOC STORAGE BATTERY





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Even in peacetime, Philco Vitrabloc would be a tremendous advance in storage battery construction. Today, when batteries must do a bigger job . . . when critical materials are a problem—Vitrabloc is a truly sensational development!

Philco Vitrabloc batteries give you greater capacity without increase in battery space. Vitrabloc incorporates the exclusive Philco Floté principle, the only construction specially designed for modern, full float service. Vitrabloc cells are explosion-proof and spray-proof.

Best of all, no critical materials are used in this vitrified ceramic jar. As a result, Philco Vitrabloc is available on exceptionally low priority!

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REPLACE WITH RUGGED, HIGH-CAPACITY PHILCO BATTERIES

Form 665-2-42 to pad

TRANSFORMER INSPECTION SUMMARY

Sheet No. 1

Division Cedar Rapids — Town or Line Cedar Rapids

Trans. Co. No.	Size KVA	Mfg.	Serial No.	BUSHINGS Primary Found	BUSHINGS Primary Left	BUSHINGS Secondary Found	BUSHINGS Secondary Left	ARRESTORS Found	ARRESTORS Left	GROUNDS Neut.	GROUNDS Arrester	Fuse Condition	OIL Level	OIL Qts. Added	OIL Cond.	LOCATION
12345	1½			O.K.	O.K.	O.K.	O.K.	O.K.	O.K.	15 Ω	15 Ω	O.K.	1" L	2	O.K.	Section map 23 Corner Oak and Elm
TOTAL																

FORMS record data on transformer condition found in tri-yearly inspection

INDIVIDUAL
TRANSFORMER INSPECTION

Division Cedar Rapids — Town Cedar Rapids — Location Sect. Map 83 — Co. No. 12345

TRANSFORMER

MFG. — KVA 1½ — TYPE — SERIAL NO.
VOLTS PRIMARY 2300 / — VOLTS SEC. 115 / 230
RATIO TAPS—YES ✓ — NO. — PER CENT 5-5

CONDITION	AS FOUND	AS LEFT
BUSHINGS—PRIM.	O.K.	O.K.
BUSHINGS—SEC.	O.K.	O.K.

FUSES

MFG. — TYPE Expulsion — CAT. NO.
MFG. RATING—VOLTS 5,000 — AMPS 60
FUSE LINK IN SERVICE—AMPS 2 amp. — WIRE OR RIBBON tin link
GENERAL CONDITION O.K.

ARRESTORS

MFG. — TYPE — CAT. NO.
VOLTS RATING 5,000 — CONDITION O.K.

GROUNDS

NEUTRAL		ARRESTOR
Neutral O.K. 15 ohms	AS FOUND	O.K. 15 ohms
O.K. 15 "	AS LEFT	O.K. 15 "
Pipe grd.	TYPE OF ROD	Rod

OIL

OIL LEVEL 1½ in. low — QTS. ADDED 2 qts.
CONDITION O.K. — LEAKS—YES — NO ✓
REMARKS: Transformer mounting okay
cross arms okay

INSPECTED BY Joe Doherty — SIGNED Richard Roe — DIST. FOREMAN
DATE 5/8/42

Inspection Records Guide Maintenance

Detailed and regular equipment inspection as a guide to preventive maintenance is assuring increased significance with the growing difficulty in obtaining new apparatus. Carefully kept records of equipment condition are essential if the fullest benefits are to be achieved from maintenance inspection.

Individual and summary transformer-inspection forms developed by the Iowa Electric Light & Power Company, Cedar Rapids, and used in the periodic inspection of distribution transformers on the system are shown herewith.

At three-year intervals each of the 3,000 distribution transformers on the system is given a thorough field inspection, at which time the condition of fuses, arresters, neutral and arrester grounds is checked. Under "remarks" on the individual transformer inspection sheet space is provided for entering any pertinent information regarding general condition of the transformer pole, transformer mounting, crossarms, etc.

Minor repairs to the transformers and accessories are made in the field by the inspection crews. However, where major defects are found the transformer is returned to the shop for reconditioning. This is generally done by a crew other than the inspection force.

•

Liquid Rheostat for Continuous Control

By G. R. SHAW
Motor Control Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

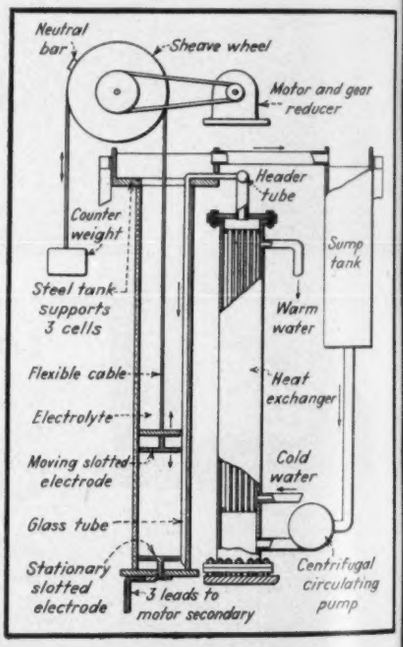
A recently developed liquid rheostat control for central station centrifugal pump and draft fan motors is continuously adjustable over a wide range of speed adjustment. This adjustment is obtained by varying the depth of the electrodes. Slip energy is rapidly dissipated through a heat exchanger, an integral part of the rheostat assembly.

Electrolyte is circulated through the heat exchanger by means of a motor-operated centrifugal pump.

The rheostat overcomes two main problems encountered with drum controllers and magnetic couplings; it is not limited by wiring and mechanical considerations to a certain number of steps or points.

The three legs of the resistor consist of three vertical columns of electrolyte which are supported in three insulating tubes attached to the bottom of a shallow steel tank. The moving electrodes are supported by flexible cables. Sheave wheels, operated in unison by a common shaft, move the electrodes up or down in the columns of electrolyte. Upper ends of the cables are connected by a copper bar forming the neutral point for the three legs of the resistor. Secondary leads of the motor are connected to stationary electrodes which form the bottoms for the three tubes. No insulators other than the three tubes containing the columns of electrolyte are required. One of the problems present in rheostats of previous designs is thus completely eliminated. This construction also reduces the total electrode separation necessary to obtain the maximum resistance required, since its eliminates all current paths of fixed resistance in parallel with the variables paths.

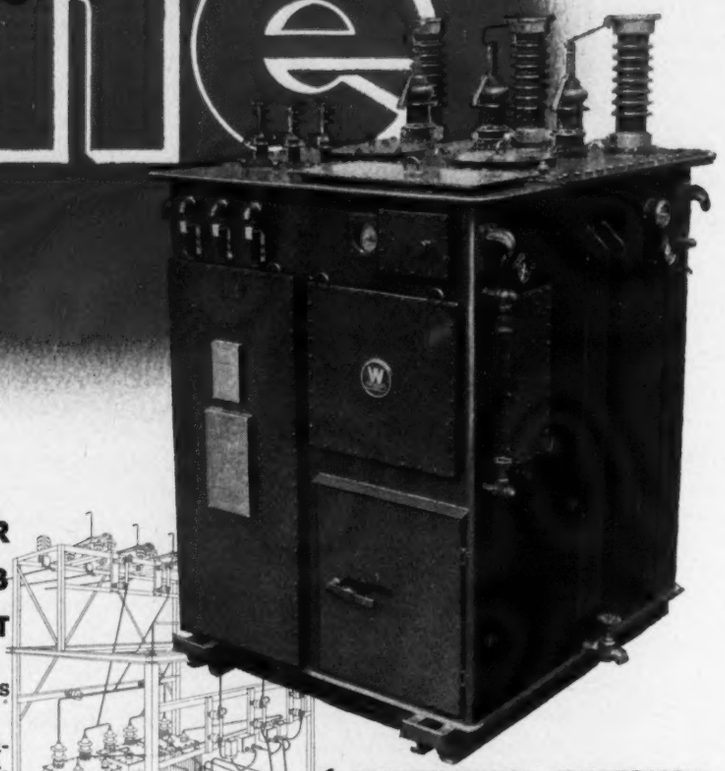
The rheostat may be operated by a small motor or by an air cylinder operating through a rack and pinion. With either method of operation, the movements of the rheostat respond to suitable combustion control equipment selected for the installation. The main shaft is provided with an auxiliary contact mechanism. One of the contacts is used to prevent starting the motor which the rheostat controls, unless the rheostat is in its proper position. Other contacts may be used as travel limits, position sig-



SCHEMATIC DIAGRAM of liquid rheostat (end view)

ONE UNIT · ONE ORDER · ONE SHIPMENT · ONE INSTALLATION

one



NEW LIGHT-DUTY CSP POWER TRANSFORMER REPLACES 43 SEPARATE PIECES OF EQUIPMENT

This complete factory-packaged substation is first choice for industrial service.

Its compactness and portability permit installation nearer the load center. This improves voltage regulation . . . and saves on copper runs.

The CSP Power Transformer performs all the functions of a conventional substation . . . it occupies less than one-third the space . . . and is better looking.

CSP (Completely Self-Protecting) means:

(1) Three-point protection against lightning.

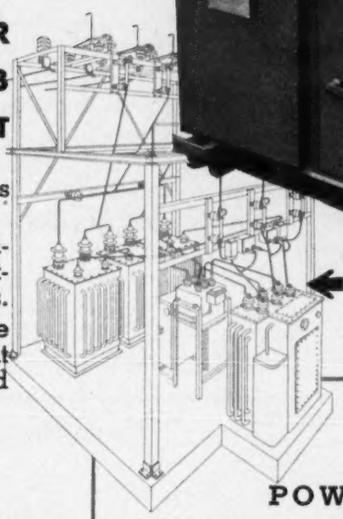
(2) Automatic protection against short circuits.

(3) Thermal protection against dangerous overloads. (Loading by Copper Temperature.)

All the thermal capacity of the transformer is made available, SAFELY . . . ideal for short-time overloads . . . conserves Critical Materials.

Ratings: 300—1000 kv-a; 50,000 kv a breaker; 13,200—33,000 volts primary; 4160 volts secondary.

For complete information, call your Westinghouse Office or write for Descriptive Data 48-150, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-70402



CONVENTIONAL SUBSTATION—with 43 components, takes up more than three times the space required by the new CSP Power Transformer.

THE CSP LIGHT-DUTY POWER TRANSFORMER:

- **Saves man-hours**—simplifies ordering, installation and maintenance.
- **Saves space**—occupies less than one-third the space of a conventional substation.
- **Saves materials**—smaller and lighter than conventional substation. Hipersil* cores save electrical steel.
- Is completely protected against burnouts.
- Is completely protected against lightning.
- Is easily moved.

* Registered trade-mark, Westinghouse Electric & Manufacturing Co., for HIgh PERmeability SILicon steel which carries ⅓ more flux.

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nals or for electrically interlocking the rheostat with other apparatus.

Lengths and diameters of electrolytic columns and other dimensions can be made to suit all common secondary voltages or currents encountered in motor designs from 200 to 10,000 hp. or more and reduction to 30 percent speed and 10 percent torque may be readily accomplished.

Electrolyte used is ordinary washing soda and is non-corrosive to the electrodes. Both electrolyte and electrodes are the same as those widely used in connection with rheostats for large steel mill flywheel sets.

•

Limit Seal Pressure, Reduce Shaft Wear

Too much water pressure applied to the lantern rings in packing glands around the shafts of centrifugal pumps has a tendency to displace the packing and cause undue wearing of the shaft sleeves. Too little pressure, on the other hand, defeats the function of the seal. At the generating station of the City Utilities, Fort Wayne, Ind., sealing water pressure applied to the glands is limited to a value between these two limits by a miniature stand pipe, height of which specifically limits the pressure that can be applied to the seal.

Most pumps are provided with a water line from the pump discharge to the packing gland to supply sealing water. This line usually is provided with a valve, which the manufacturer intended should be partly closed to throttle water pressure to a moderate value. In actual practice operators, suspecting gland leaks, have a tendency to open the valve full on the theory that too much pressure can do no harm. As a matter of fact, however, excess sealing water pressure can distort the packing and eventually wear the shaft sleeve.

At Fort Wayne a 1-in. diameter "stand pipe" is used with a sewer connection at an elevation above the pump sufficient to maintain a positive pressure differential of about 5 lb. per sq.in. on the sealing gland. Thus with a pump having a suction lift of 8 ft. a 20-ft. stand pipe would be sufficient.

Use of such control over sealing water pressure has materially reduced sleeve wear at this plant, it is stated.

Reed Frequency Meter with Laminated Core

By DONALD E. ANDERSEN
Development Engineer
J-B-T Instruments, Inc., New Haven, Conn.

Vibrating reed frequency meters are familiar in the field of frequency measurement, but a meter embodying new features of design is being manufactured by J-B-T Instruments, Inc. This new principle of design was first made practical by F. J. Lingel, engineer, of the Triplett Electrical Instrument Company of Bluffton, Ohio.

The original design (Fig. 1) is still being used in most models. "A" is a coil surrounding the reed "B" rigidly held in the mount "C," which is attached to the framework of the instrument. "D" is a permanent magnet whose field exerts a slight pull on the reed. The coil, of course, magnetizes the reed. The varying alternating field from the coil in conjunction with the undirectional field from the permanent magnet tends to make the reed vibrate. Unless the resonant frequency of the reed is the same as the frequency of the alternating field, however, there will be little or no vibration. Tuning is accomplished by varying the length or thickness of the reed or by changing the weight "E" at the free end.

In a recent development (Fig. 2) the coil "A" has a laminated core and the magnet "D" is arranged with one end against the laminations. The reed is attracted in value by the alternating flux from the coil. As with the other type of design, if alternating-current frequency is the same as the resonant frequency of the reed, the reed will vibrate. The laminations permit a much reduced excitation current, the impedance being 260 ohms per volt at 60 cycles; the power consumption at 115 volts is only ½ watt.

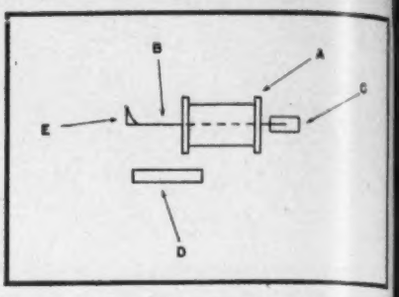


FIG. 1—Conventional reed meter excites reed by means of coreless coil through which it passes axially

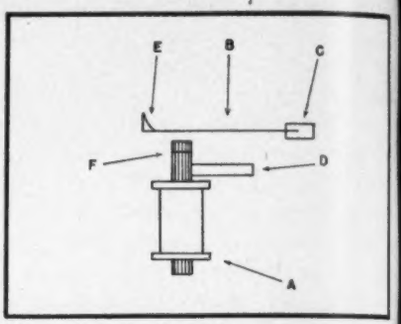


FIG. 2—New principle has rectangular laminated coil whose axis is perpendicular to the reed lengths

"Transformer Fusing" (Correction)

Delta-Connected Primary

Fig. 1

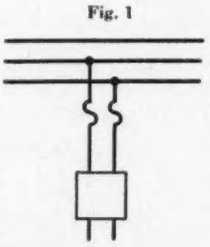


Fig. 2

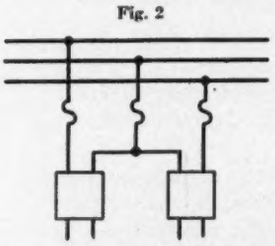
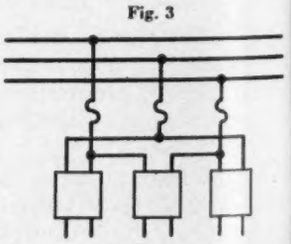


Fig. 3



Star-Connected Primary

Fig. 4

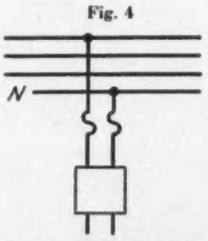


Fig. 5

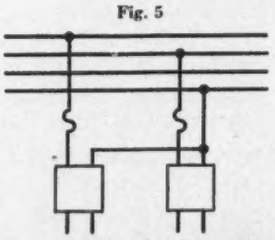
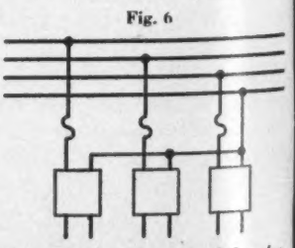


Fig. 6



In the February 20 issue, page 84, under "Suggested Primary Fusing Schedules for Distribution Transformers" an error occurred in publication of the diagrams of transformer primary connections. The diagrams should have appeared as shown here. This corrected arrangement may be cut out and pasted over the reversed diagrams.

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Fiberglas Braided Sleeving
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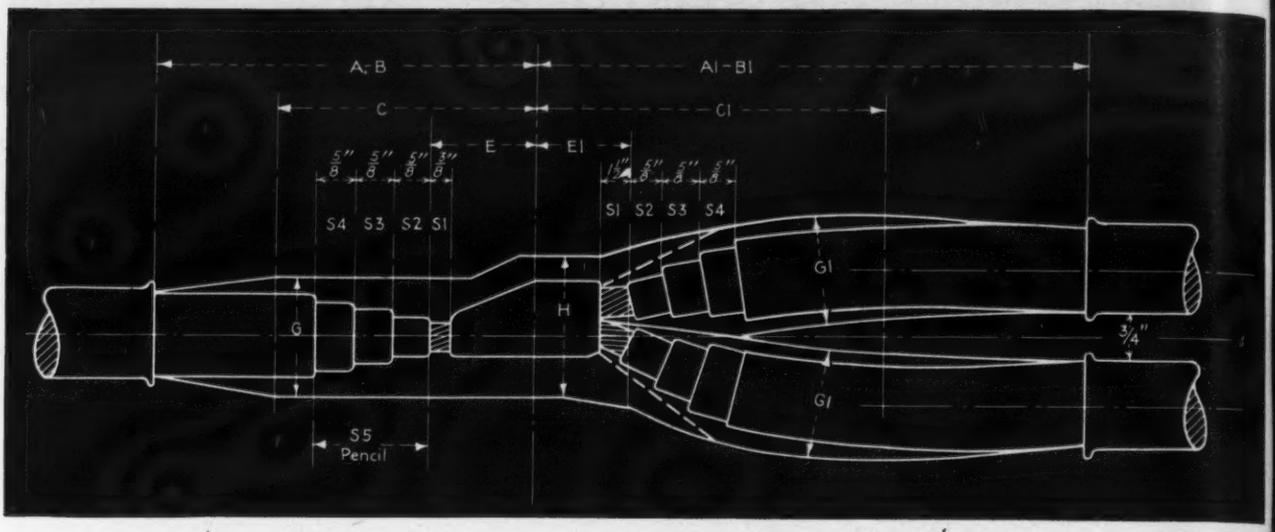
Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

HOW TO CONSTRUCT *

Bifurcating Cable Joint
10 to 15-Kv., Paper-Insulated, Single-Conductor Cable



Cable Data			Joint Dimensions — Inches										
			Main Cable					Branch Cable					
						G					G1-11 Kv.		G1-13 Kv.	
Operating voltage	Paper Insulation, In.	Cond. & Connector*	A-B	C	E	11 Kv.	13 Kv.	A1-B1	C1	E1	Concentric	Compack	Concentric	Compack
Grounded 11,000 and 13,000	12/64 and 14/64	1/0	6 1/4	4 1/4	1 5/8	1 1/4	1 3/8	9 3/8	6	1 3/4	1 1/4	1 7/32	1 3/8	1 11/32
		4/0	6 1/2	4 1/4	1 5/8	1 15/32	1 19/36	9 3/8	6	1 3/4	1 15/32	1 13/32	1 9/32	1 17/32
		250	6 1/2	4 1/4	1 5/8	1 17/32	1 21/32	9	6	1 3/4	1 17/32	1 15/32	1 21/32	1 19/32
		350	6 1/2	4 1/4	1 5/8	1 43/64	1 51/64	.....	6	1 3/4	1 43/64	1 39/64	1 51/64	1 47/64
		500	6 3/4	4 1/2	1 7/8	1 27/32	2	.....	6	2	1 27/32	1 3/4	2	1 57/64
		750	7	4 3/4	2 1/8	2 7/64	2 15/64	.....	6	2 1/4	2 7/64	2 1/64	2 15/64	2 9/64

* Size, AWG or Mcm.

Procedure for making a cable joint which divides into two branches includes the general jointing procedure and the following special instructions. Joint dimensions and material list for several cable sizes are included.

1. After sweating the connector spread the branch cables to about 30 deg.

2. Apply insulation over the steps of all cables as indicated in the general procedure, using 3/16-in. tape on step S1 and ½-in. tape on remaining steps.

3. Using 1-in. tape, apply over-insulation to each branch cable up to diameter G1 between the end of step S3 and the point located by dimension C1, tapering the ends to the connector and the lead sheath.

4. Bring the branch conductors to their final position, with ¾-in. space between the lead sheaths. Place a wedge between the cables and bind together, far enough back so as not to interfere with the wipe.

5. Apply over-insulation to main cable and connector, using 1-in. tape. Starting at the lead sheath on the main cable carry the insulation across the joint to meet insulation on branch cables.

Continue wrapping, adding extra turns over the connector, until the diameter over the main cable between the points located by dimensions C and E equals G and the diameter H over the connector equals the long diameter of the connector plus ¾ in. on 11-kv. and ⅞ in. on 13-kv. cables. All changes in final diameter should be accomplished by tapering as shown on drawing.

Lead Sleeve Dimensions

Length equals A + A1 + 3 in., rounded to the next larger even number.

Diameter equals the sum of the o.d. of branch cables plus 1¾ in. rounded to the next larger half inch.

Material List

Cable		Varnished Cambric Tape — 4 yd. Rolls				
		3/16 x 0.012 In. (Note B)	1/2 x 0.012 In. (Note B)		1 x 0.012 In (Note B)	
Operation and Use	Conductor Size, AWG or Mcm	11 & 13 Kv. Con. & Comp.	11 Kv. Con.	13 Kv. Comp.	11 Kv. Con.	13 Kv. Comp.
Grounded Main	1/0	1	3	4	11	13
	4/0	1	4	5	15	18
	250	1	4	5	17	20
	350	2	5	6	19	24
	500	2	5	6	22	26
	750	2	6	8	26	37
Grounded Branch	1/0	3	9	12	33	39
	4/0	3	12	15	45	54
	250	3	12	15	51	60
	350	4	15	18	57	72
	500	4	15	18	66	78
	750	4	18	24	78	111

NOTE: A — Stepping of insulation is standard; penciling is optional.
B — V. C. Tape: Use 3/16-in. tape on step S1; 1/2-in. tape on step S2, S3, S4 and S5 (pencil); 1-in. tape for over-insulation.

* Adapted from Underground Construction Standards of New England Power System

Dunco Quality
INDUSTRIAL CONTROL RELAYS

Although Struthers Dunn, Inc. makes many more complicated, and therefore more "spectacular," relay types, there are none in which Dunco design and manufacturing care have proved more effective than in these Industrial Control and Power Transfer types commonly used for controlling motors, heats, lights, and for other industrial tasks.

Their success over a long period of time has been largely a matter of refinement of every detail having a bearing on performance and dependability—and topping this off with individual adjustment plus two separate inspections before shipment.

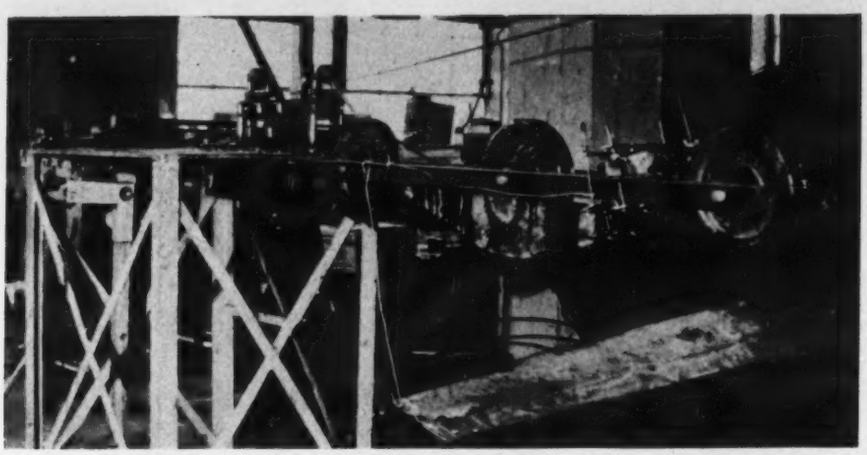
Dunco Industrial Control and Transfer Relays are made in many types and with mounting styles for almost any application.

WRITE for your copy of the Dunco Relay-Timer Catalog and Data Book. Contains details on the largest line of high-quality relays and Timers, as well as helpful engineering information.

STRUTHERS DUNN, Inc.

1321 ARCH STREET **PHILADELPHIA, PA.**

LET DUNCO DISTRICT ENGINEERS IN 28 CITIES HELP SOLVE YOUR RELAY-TIMER PROBLEMS



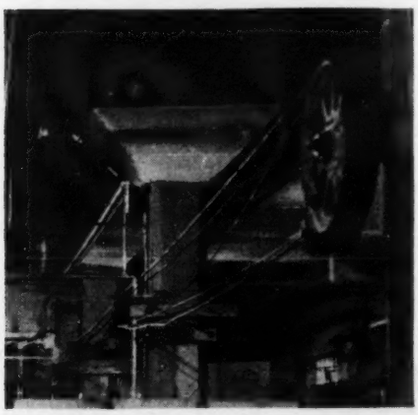
COATING TANK through which old weatherproof wire passes for treatment with compound

"Resurfacing" Old Weatherproof Wire

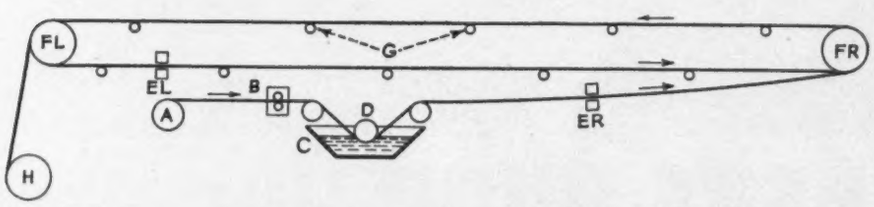
Old weatherpoof wire, on which the covering is not too badly worn and frayed, is not stripped but is salvaged and treated for use again as weatherproof by the Washington Water Power Company, Spokane. While not guaranteed as good as new, when they finish the treatment at the warehouse — splicing, straightening, coating with Gilcoat (Fuller Paint Company) and recoiling—the wire serves the purpose and makes a presentable appearance when strung.

Arthur Thomas, warehouse foreman, has built a rig for treating the wire. The wire is drawn from a pay-off reel, passes through a wire straightener, through a small receptacle containing the compound, back and forth across the shop, around two grooved pulleys at the extremities and over a series of rollers near the ceiling, and finally to a power take-up reel. Altogether, about 900 ft. of wire is on the ways from reel to reel, and after traversing this distance in approximately 25 minutes the compound is dried sufficiently to permit winding the wire into coils. In the course of its travel the wire passes through sets of grooved wood blocks, which work the frayed and rough insulation to a smooth surface, which is maintained by the stickiness of the compound until dry. The rollers for the overhead track consist of lengths of pipe turning on ⅝-in. bolts.

All good, short pieces are spliced in, even down to 3-ft. lengths in the case of No. 6 and No. 8 weatherproof. The splices are hand made, without the use of sleeves, the joints being dipped in solder reclaimed from underground cables. Each joint is straightened while hot and then taped. The solder pot consists of a counterbalance from an old street-lighting transformer. This rests on a heater which is a 1,000-watt unit from an old surface unit electric range.



VIEW of one grooved pulley and several passes of wire across the shop to give time for drying



SCHEMATIC arrangement of equipment for reclaiming weatherproof wire

A—pay-off reel. B—wire straightener. C—tank for coating compound. D—sheave ducks wire in compound, level of which is below sheave bearing. EL and ER smoothing blocks. FL and FR—grooved pulleys. G—rollers. H—powered take-up reel.

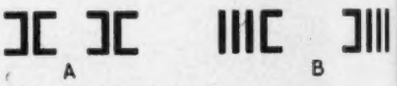
Practical Shapes of D.C. Bus Conductors*

By WILLIAM DEANS
Chief Engineer
I-T-E Circuit Breaker Company, Philadelphia

The flat bar is the simplest kind of conductor used in busbar structures. Cables are sometimes used. The discussion for d.c. and a.c. buses will be limited to bars and other structural shapes.

For d.c. buses the flat bars may simply be added one to another, all of the same thickness, and with due regard to the matter of dissipation of heat. Required cross-section of the conductor may be obtained by choosing a suitable number of similar bars.

The bars are arranged usually side by side, with their longer cross-



TWO arrangements of conductors for high d.c. capacities

sectional dimension vertical so as to permit the air to flow between them. In this arrangement the direct current will distribute itself between the bars.

For d.c. applications it is not necessary to be concerned about skin effect ordinarily, but some interest must be given to proximity effect for the interval during which short-circuit current flows.

In view of the greater ease for making taps and connections it is quite usual to find a bus with channels back to back. Other d.c. buses have been constructed of combinations of flat bars and channels, as shown in the illustration.

So long as the direct current is constant in magnitude, the currents will be divided among the elements of the composite conductor according

* This is the sixth in a series of seven articles on the general subject of Bus Design, which began in the December 26, 1942, issue of "Electrical World."

How to Get More Life From Worn-out Boilers

If they can pass inspection and a hydrostatic test, APEXIOR will "peg" that condition for more years of good performance.

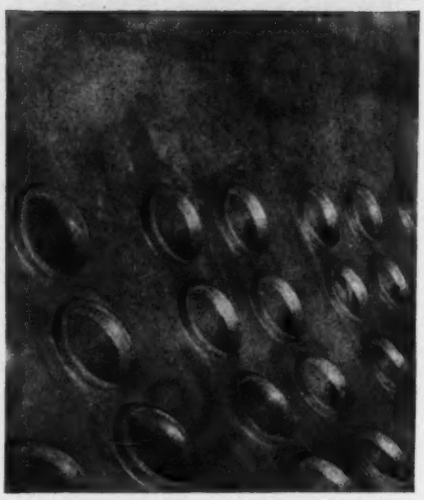
Those boilers nearing the end of their life . . . those boilers already on the inactive list — there's an excellent chance you can get more years of work out of them by APEXIORIZING.

Any boiler that can withstand the required hydrostatic pressure is good for plenty of hard service — if the test strength of the metal is maintained by a durable coating of APEXIOR.

APEXIOR PREVENTS CORROSION FOR 2-3 YEARS

APEXIOR is brush-applied, by hand or power-coater. It fills in the metal pores and joints and forms an impenetrable barrier against water. There is less adherent scale, so scale removal is made easy (with a wire brush) . . . and less often required.

Hundreds of operators have used



APEXIOR for years as an economical means of boiler maintenance. Hundreds more have recently adopted APEXIOR as a guarantee of longer life for metal that cannot be replaced.

An APEXIOR coating will last 2 or 3 years, often longer. It is easily renewed. Save *your* boiler metal from wear and damage that cannot be measured in dollars. APEXIORIZE — and keep boiler metal young.

Easy to Apply — Easy to Maintain — Bulletin 1290 Gives Facts on a Paint that Gives Metal New Life.

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to their respective resistances, and, therefore, according to their cross-sections. Each of the individual conductor elements will take its own share of direct current. During the time that the fault current increases to its final value, however, the proximity effect governs the distribution of the current. Most of the current will be forced into the parts of the conductor nearest to each other.

The channel has a much higher section modulus than a flat bar and even though the currents are close together by the proximity effect, and the forces due to electromagnetic action are thereby increased, because of the greater section modulus of the channel, a reasonable spacing of bus supports is permissible. Taps and connections may be made very conveniently for either of the arrangements shown.

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Wood Panel Serves for Wartime Metering

By E. E. KLINE

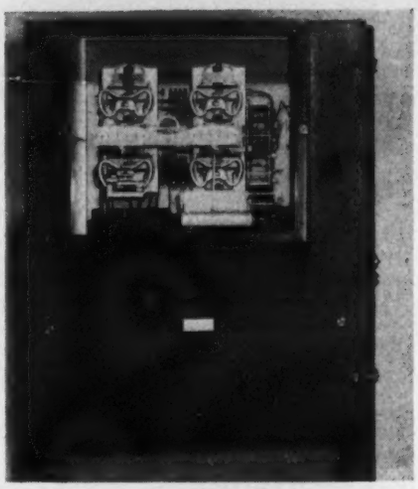
Superintendent Electric Meters and Tests, Cincinnati Gas & Electric Company

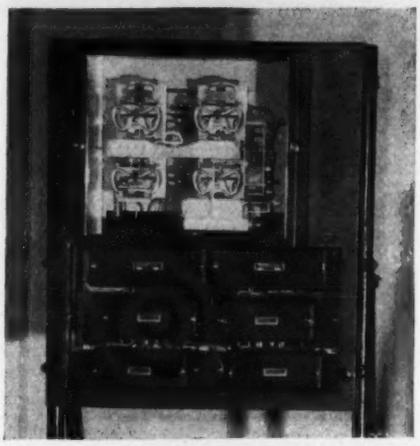
An early application of fundamental metering principles illustrates forcibly how the requisite units for metering a rapidly expanded war plant can be combined compactly and safely, with a resultant saving in strategic materials, space for installation and panel-wiring time.

To assure adequate and continuous service to this essential factory a rather elaborate bus layout supplied by six primary feeders is required. But, since all loads are served through two main buses, a duplex meter suffices for complete metering.

Since the billing contract calls for a totalized kva. demand of all circuits, a Westinghouse type RI-32 totalizing recording kva. demand meter was selected for the job. This meter records total kwh. and kvah., totalized kw. and kva. 15-minute integrated demand. An auxiliary relay insures potential to the timing circuit in the event that one bus is out of service.

Because of the shortage of steel and the uncertain delivery of steel products for installations with even the highest priority ratings, it was decided to construct the panel of $\frac{3}{4}$-in. plywood, thus eliminating the need for about 85 pounds of steel normally used in a panel of this size. The unique design of the 30 x 36-in. plywood panel, 7 in. deep with installed equipment, is similar to that developed previously in this utility for standardized metal panels.





NEW-STYLE wood panel with and without accessory cover; double accessories used for three-phase, three-wire service.

Chief feature of the panel is that all equipment, except the meter, is housed in a boxed-in portion of the panel under a flush-mounted sealable dead-front cover. This concentration of equipment effects a saving of nearly 50 percent of the copper wire used on a conventional back-connected panel. All equipment is accessible from the front of the panel and the unit may be installed close to a wall, mounted on standards or on the wall. One important objective attained in the design of this new-style panel is that it is interchangeable with all previous 30 x 36-in. panels used here without any change in the mounting facilities. Typical panels formerly used required a clear space of at least 20 in. between the panels and adjacent objects to permit access to the equipment mounted under an inclosure on the rear of the panel in normal switchboard style.

An idea of the compact arrangement of the panel unit may be gained from the following list of equipment (with approximate dimensions) which must be mounted on it:

Metering Equipment	Dimensions, Inches Width	Height	Depth
1 RI-32 meter	20	18½	9¼
2 "Reactiformers" (with test switches)	11½	3½	3½
2 Test blocks	9½	4	3½
2 Connection blocks and fuse mounts	9½	4	3½
1 Relay	4¼ diam.		2½

Arrangement of the equipment permits the use of a minimum amount of panel wire for interconnection of the accessories, without sacrifice of safe clearances for test and maintenance operations. All panel wiring is color coded to permit easy tracing of the circuits.

At the best some of the devices which have been, and will be, resorted to because of shortages of vital materials cannot be expected to be as completely satisfactory as normal practices developed primarily for quality performance; at the worst they may be merely poor temporary wartime expedients to accomplish the most with what is available. But, in metering as well as in other fields, it is being proved day after day that the proper application of ingenuity can produce worth-while "pinch-hitters" for the duration of the war.

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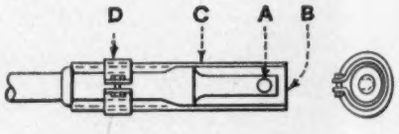
Small Wire Soldering Simplified



The job of soldering small wire connections is simplified at General Electric by making the iron stationary and dipping the connections into a small hole filled with solder near the tip of the iron.

As shown by the drawing, the soldering iron can be fixed for use in this manner by drilling a hole (A) into the tip (B). A nickel steel tip will last longer than other types.

The drip and splash guard (C) catches surplus or drips of solder coming off the iron. It is made of $\frac{1}{32}$-in. steel and is fastened to the iron with a hose clamp (D).

Official U. S. Army Photo

Here's What It Takes To Build Your Glory Road

When a Colonel of engineers said the new Alcan Highway—the "Glory Road of America"—was built by "guts and tractors" he stressed the former.

ALTER EGO: And how right he was! When tough "competition" from the west threatened to annihilate us, it jolted us into super-action. Alcan's 1800-mile route through uncharted wilderness — said to be *impassable* — was a confusion of mud, mountains and mosquitos. Under the spur of Jap "competition", we finished this "glory road" in one season.

Maybe that's a lesson for us to be on the alert for the tough competition that'll invade all business after the war. Let's jolt ourselves into super-action now.

ALTER EGO: Right! We've got to hack through plenty of uncharted wilderness that seems impassable . . . with little time on our hands . . . and come out with *better products* and *lower costs* than the other fellow. *Will-power* and *ingenuity* will build *this* "glory road".

We have the will-power. Let's acquire the ingenuity by improving our welding knowledge *with Lincoln's aid.*

Ask your inner self if welding knowledge isn't the shortcut to postwar success.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND, OHIO

HOW TO SAFEGUARD AGAINST TRANSFORMER FIRES

Recommended practices for transformer installations outlined by Associated Factory Mutual Fire Insurance Companies, Boston

OIL-INSULATED TRANSFORMERS

In oil-insulated transformers fire may result from overload or from a breakdown in insulation on the windings brought about through gradual deterioration; low oil, moisture, or acid in the oil; a strain caused by a surge, or other causes. It may also result from grounding of the terminal leads.

Outside Transformer Installations

To minimize the amount of damage from outside transformer fires, the following is suggested:

1. Prevent spread of escaping oil; use a drained concrete base with a 6-in. curb, and fill base with coarse crushed stone.

2. For large installations:

(a) Provide portable spray nozzles or other oil fire protection. A fixed installation of water spray nozzles or carbon dioxide is sometimes advisable in large and important installations, particularly where use and occupancy is an important factor. Plans for such protection should always be submitted to the insurance company for approval.

(b) If large transformer installations are located near a building, the wall, within 10 ft. of the transformer, should be a blank fire wall (windows bricked up). Exposed windows between 10 ft. and 20 ft. from the transformers should be wired glass in steel sash. More distant windows may be plain glass in steel sash, although wired glass is preferable. All exposed woodwork or other combustible construction should be eliminated or protected.

3. For ordinary installations (less than three 333 kva., such as found at most manufacturing plants):

(a) Wired glass in steel sash within 10 ft. should provide adequate window protection above the level of the top of the transformer. Windows directly back of transformers and below the level of the top of the transformers should be bricked up, as they would be in contact with burning oil or might be broken by hose streams.

(b) In the case of large installations it may be desirable to replace wooden sash with steel sash or replace or protect other outside combustible construction above the transformers. Flames from fires in relatively small transformers may extend high into the air and ignite exposed combustibles.

Inside Transformer Installations

When transformers of the oil-insulated type are located inside a manufacturing building the following arrangements should be followed:

1. Transformers Not More Than 600 Volts and 10 Kva.—May be installed without a vault in a building or room of any construction. If there is no combustible material in the vicinity of the transformer and if the building is non-combustible, automatic sprinkler protection is not needed.

2. Transformers Not More Than 600 Volts, and Not More Than 25 Kva. in Any One Unit, or Not More Than 75 Kva. Total Rating—May be installed without a vault in a building or room of fire-resistive construction and containing no combustible material in the vicinity of the transformer if surrounded by concrete curbs not less than 6 in. high forming a basin of sufficient capacity to retain all the liquid used in the transformers. Sprinklers are not needed, but large hose stream protection should be available.

3. All Transformers More Than 600 Volts, or 600-Volt Transformers More Than 25 Kva. in Any One Unit, or More Than 75 Kva. Total Rating—Provide a well-ventilated transformer vault or room of non-combustible construction with no exposed building structural steelwork—well cut off from adjoining buildings. Vaults in a main building should preferably adjoin an outside wall and, if possible, the doorway and ventilating openings should be in this outside wall. Brick or concrete curbs should be provided at the doorways so that burning oil will not escape. When the total transformer capacity in a room exceeds 100 kva., the room should be drained through liberal-sized, trapped pipes to safe points, preferably to the sewer if this is allowed.

Transformers of 750 kva. rating or larger should be set in individual concrete basins surrounded by a concrete curb 8 in. high and with individual trapped drains for each basin.

TRANSFORMERS FILLED WITH A NON-FLAMMABLE LIQUID

Transformers cooled by a non-flammable liquid (Pyranol, Inerteen, etc.) May usually be located anywhere inside a building without providing vaults, except in hazardous locations, with the provision that high-voltage circuits must be protected in accordance with the National Electrical Code. The cost is appreciably greater, but in many instances a complete installation of fire-safe transformers may be less costly than the use of an oil-filled transformer plus necessary safeguards.

Non-flammable insulating liquids should be used only in transformers designed for them.

DRY-TYPE TRANSFORMERS

Dry-type transformers have sufficient radiating surface so that natural circulation of air is usually adequate for cooling. Early types have combustible insulation which may burn vigorously as described for air-blast types, but recently most of these transformers have been made fireproof, by using porcelain, asbestos, mica, glass, etc. They may now be obtained in sizes up to 1,000 kva.

Installations of the fireproof units may be made anywhere within a building except in hazardous areas, with the provision that high-voltage circuits must be protected per National Electrical Code.

AIR-BLAST TRANSFORMERS

Air-blast transformers depend on the forced circulation of air for their cooling. Most such transformers now in use have combustible insulation, and in case of electrical breakdown, this insulation will burn fiercely due to the draft of air.

This type of transformer is located over pits or air passages, which should be of non-combustible material. A tight damper should be provided in the passage of each transformer, another in the top of each unit, and if possible still another under each transformer. In case of fire, these **dampers should be closed quickly.**

Water can be effectively applied through an open sprinkler or perforated pipes permanently installed in the top of an air-blast transformer and connected to a clean water supply by means of a short section of hose or pipe, normally disconnected, but which can be quickly coupled. Small hose (1½ in. linen or ordinary garden) has also been found effective for use *after* the power has been cut off.

We waited 4 Years to make this *Announcement*

★ ★ ★

EARLY IN 1938, Shell Scientists and engineers, after long tedious months of experimenting, were ready to give a new turbine oil its supreme test. Exhaustive laboratory analyses had shown it possessed properties previously thought unattainable by even the most optimistic turbine manufacturers.

But Shell men were not satisfied. "How will this new turbine oil stand up under actual operating conditions?" was the question they wanted answered.

There was but one way to find out . . . test it in turbines. They did. After a 2-year run, samples taken showed every characteristic of the original oil. Further checking was done . . . other tests were made. It still looked "as good as new."

Then, and only then, was the new Shell Turbo Oil announced. That was in January 1941. Even then many operators were doubtful that Shell Turbo Oil was as good as we claimed. "It hasn't been in use long enough," they said.

Today Shell Turbo Oil is able to show a performance record that should convince the most skeptical. For after more than 30,000 hours of operation in a power company's turbine, Shell Turbo Oil tests as well as the day it was put in over 4 years ago. To the original filling of 4,400 gallons only 300 gallons of make-up oil have been added. Certified chemical analyses of samples taken from the turbine show no signs of deterioration on any score.

30,000 hours of operation, in itself, is no record for a turbine oil. But 30,000 hours *without a single sign of structural breakdown* is a record in which every turbine operator should be interested. It is but one of scores of records being set by the new Shell Turbo Oil in all types of turbines.

Here is proof positive that the new Shell Turbo Oil has *the two most important* characteristics necessary to the proper lubrication of modern turbines:

SUPERIOR OXIDATION STABILITY
RUST PREVENTION

Ask the Shell man for the details today!

(Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil.)

Shell Turbo Oil

Hot-Spot Indicator Monitors Series Lights

By JOSEPH R. TOOMEY
Chief Electrician, Woonsocket Division,
Blackstone Valley Gas & Electric Company,
Woonsocket, R. I.

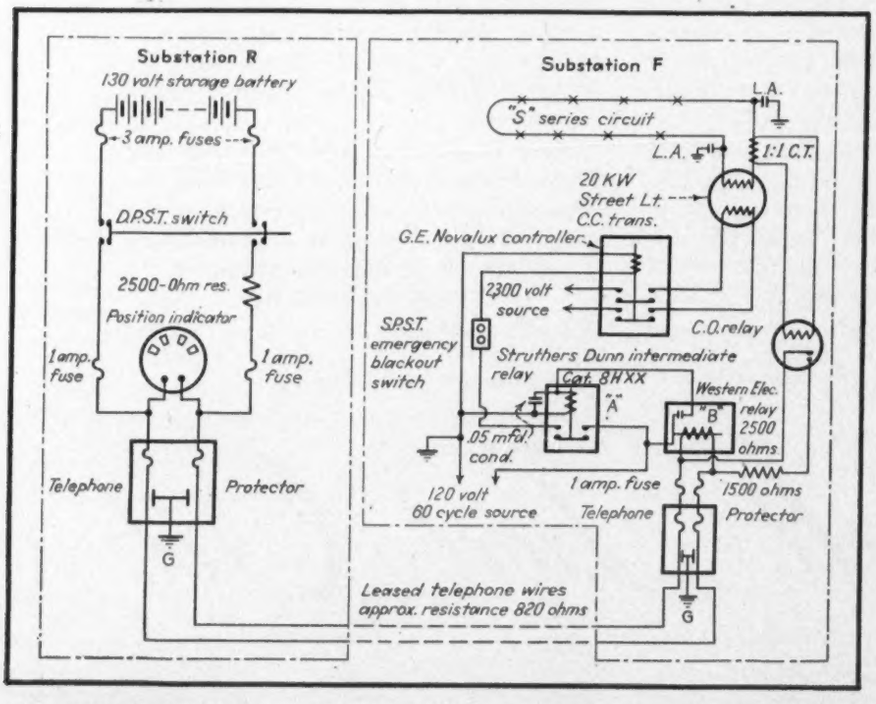
Need for immediate dousing of a suburban series street light circuit upon receipt of a blackout signal and prompt turning on again with the all clear required that some form of remote control be installed so that the circuit could be manually operated from an attended substation approximately 3 miles away.

We were fortunate in having on hand equipment which might, with slight alteration, be used over a pair of wires leased from the telephone company. The indication wanted at the attended substation was that the various control devices were operating properly and that the series loop was closed and carrying 6.6 amp. The available equipment consisted of relays, resistors and an indicating instrument, all of which had been used for totally different purposes, but discontinued for one reason or another.

The intermediate relay (A), which replaced the time clock, is a standard a.c. auxiliary relay and required no changing. The Western Electric relay (B) was polarized for telephone service, but was rebuilt for present use so that the contacts spring open when the relay is de-energized.

A switchboard-type transformer hot-spot temperature indicator, which is really a sensitive voltmeter calibrated in degrees, was used to provide the indication. Various amounts of voltage drop across the control circuit were made to indicate (1) that there was no potential on the control circuit, (2) that the control circuit was open, (3) that the control circuit was closed and energized but the series circuit was not operating, either because of some failure at the outlying substation or because the series loop was open, (4) that the series loop was carrying current. The result of these indications is that the street light patrolman is relieved of the need of many miles of driving, with the consequent saving in gasoline consumption and wear of tires.

It was possible to use the temperature indicator for this purpose by inserting a 35,000-ohm, one-watt resistor (originally, meant for a radio) in series with it and drawing a new scale. A 1/1 insulating transformer with its primary in the series circuit has a type C O relay in its secondary. The current tap screw of this relay is in the 6-amp. tap and when 6.6 amp. flow in the series loop the relay contacts are held closed. These contacts put additional load in shunt with the relay (B) to provide the voltage drop in the control circuit, which deflects the voltmeter pointer to the position indicating that the street lights are on. If for some reason the street lights do not go on, the first deflection of the pointer when the control circuit is energized by the push button remains unchanged. If the control circuit has an "open" in it the pointer will take up a full scale deflection.



STREET LIGHT CONTROL converted from time-clock operation to remote manual control by applying temperature indicating instrument as the indicator; only on-hand material used

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Maintenance of Insulating Oil

X. Carbon Removal*

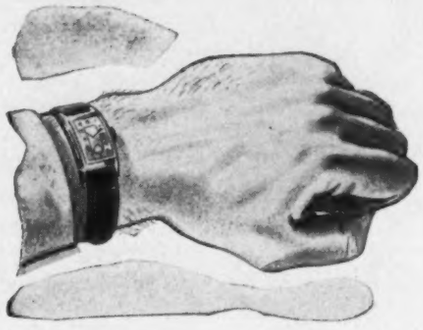
By L. M. LIMPUS
Superintendent of Reclamation
Oklahoma Gas & Electric Company

Amount and perhaps the form of carbon produced in the oil of a circuit breaker is governed by the type of breaker contact, the material from which it is made, the direction of its motion, the frequency and speed of its operation, the voltage and load characteristics of the circuit interrupted and the interrupting duty imposed upon the breaker. As the principal hazard of carbon contamination is a function of the reduction in creepage strength along the surfaces of the insulations, it is quite difficult to predict or define a hazardous condition. The standard dielectric test of the oil sample may or may not disclose the hazard, the judgment of an experienced inspector is not always infallible and a visual inspection cannot always be relied upon to indicate the danger of an immediate failure. It is therefore standard practice to inspect and clean breakers more often than necessary. It is hoped that power-factor testing, which may disclose weakened surface creepage strength, may eventually prove to be a reliable means of predicting the actual existence of such hazards.

From a practical maintenance standpoint, the dielectric test of the oil can be relied upon to disclose only the presence or absence of moisture or colloidal carbon in suspension within the oil, and is in no way an indication of the existence or nonexistence of a hazardous carbon concentration. The power-factor test requires special equipment, expert diagnosis, and is even then unreliable unless the breaker can be isolated from all of the associated instrument transformers, disconnect switches,

* This series began in the October 31, 1942, issue of "Electrical World."

The last hour of the War



NO MAN KNOWS when the last hour of the war will come. But it will come sooner as war production is increased tonight and tomorrow and tomorrow. If this isn't so, then all talk of production is folly.

Ending the war sooner—pulling the end closer to us even by an hour—can mean life or death to thousands.

In one hour a machine gun can spit out over 10,000 bullets. In one hour an anti-aircraft gun can fire over 1000 shells.

In one hour a battleship can deliver more than 500 tons of armor-piercing steel over 14 miles.

In one hour a group of 1,000 bombers can drop 2,000 tons of bombs, badly damaging a city the size of Cleveland or St. Louis or Los Angeles or even Philadelphia or Chicago.

Every hour of the war is important—but ending the war even one hour sooner can be your goal, and ours. No one knows exactly what happened in World War I, in that last hour between ten and eleven A.M. on November 11th. But throughout the morning of November 11th, according to the casualty lists published in the New York Times, 1,021 American boys were either killed in action or seriously wounded.

And the tempo of this War, compared with World War I, is like a tropical hurricane compared with a March wind.

So when we help break a production bottleneck, help speed production with better light, we have a right to feel that we are helping end the war seconds sooner. And any one of us, who by his own efforts quickens necessary production to the tune of 100,000 man hours in a year, can rightfully hope that he may be helping end the war by even one hour.

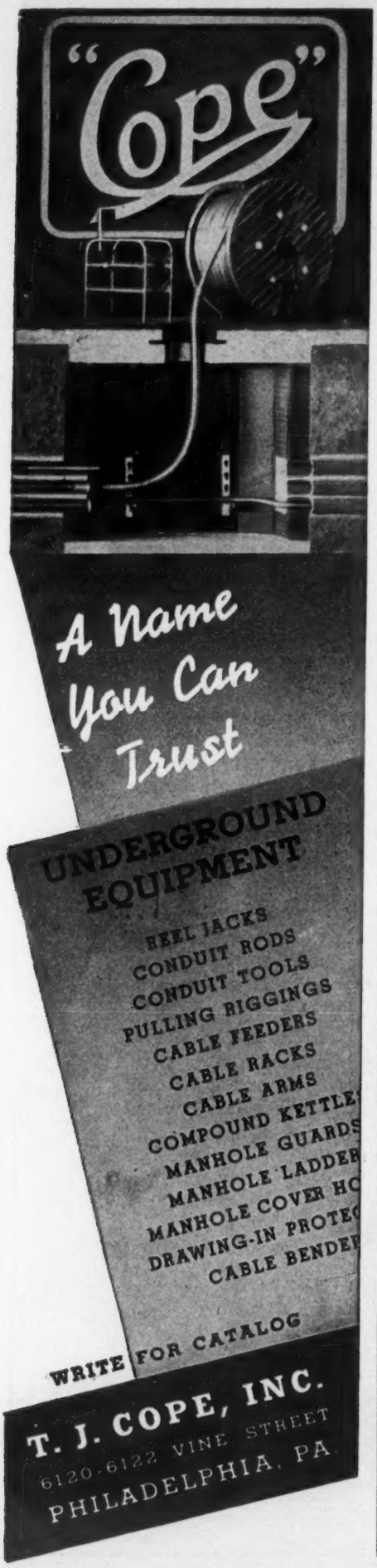
Tonight and tomorrow—the hours we put in speeding production are the most important hours in our service to our country. They may be the most important hours in our personal lives.

Perhaps someone you knew and loved was killed on the morning of November 11th, 1918. Perhaps someone you know and love will remain alive in the last hour of this war, because you did what you could tonight and tomorrow!

G-E MAZDA LAMPS

GENERAL ELECTRIC

General Electric offers you the services of its lighting engineers as well as a complete plan to help your industrial customers speed production—and so end the war sooner. See your local General Electric Lamp Division office or write General Electric Company, Department 166-EO-J-1, Nela Park, Cleveland, Ohio.



taped connections, etc. As the visual inspection and the judgment of the inspector are about all that remain, during the average breaker inspection, to determine the permissible amount of carbon deposit, creepage surfaces must be carefully inspected, taking into consideration the creepage distance, the stress imposed by the electrostatic field, the normal and surge voltages across the distance, the extent of the carbon deposit, the possible exposure of the carbon to moisture contamination and the cost of oil reclamation or replacement. Carbon precipitated in the bottom of the tank is of consequence only in so far as repeated operation of the breaker may so agitate the oil that this carbon will become thoroughly dispersed and will then exist in such a suspended concentration that the over-all dielectric strength of the breaker—not an oil sample as tested in the standard test cup—will be reduced to a value permitting a puncture of the oil barrier, which inherently has a very long gap to ground.

Recondition Processes

Many processes are now in use to recondition successfully circuit breaker oil for reuse in breakers, but few of these processes remove a sufficient amount of the colloidal carbon to render the oil entirely suitable for reuse in other apparatus. The centrifuge alone cannot be depended upon to remove a sufficient amount of the finely divided carbon to render the oil entirely suitable for reuse in any kind of oil-insulated equipment. If the oil has only a small percentage of carbon a blotter press is used to advantage, but if it has a large percentage of carbon or water a combination centrifuge and blotter press is recommended. As carbon formation may be reduced as much as 50 percent by additionally refining the oil with sulphuric acid, perhaps any of the processes for re-refining acidized oils may be quite desirable for the reclamation of carbonized breaker oil. Herein the modern deep-frame filter press which was designed primarily to recondition Pyranol, using a bed of fuller's earth in series with the blotting papers, may have its purpose extended to include breaker oils as this earth has a slight tendency to "over-refine" mineral insulating oil. All things considered, unless a breaker oil is re-refined to insure the complete removal of all traces of colloidal carbon, once an oil is consigned to breaker service it should not be reused in any other type of equipment.

Whenever it becomes necessary to reclaim or replace breaker oil, all trace of carbon should be removed from the interior of the tank and other internal appurtenances.

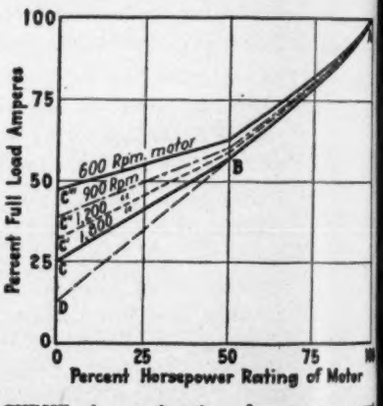
•

Simple Method for Checking Motor Load

By JOSEPH A. SETTER
Industrial Department,
General Electric Company, Denver, Colo.

Loading on integral-horsepower induction motors can be determined with practical accuracy by means of a hook-on volt-ammeter. The method is of unknown origin, but has been used with practical results by several plant electricians for a number of years and has been checked for accuracy with design data of motors. With this method it is not necessary to lose productive time, because the leads to the motor need not be disconnected to make the tests.

Here are the seven simple steps to be taken in using this method:



CURVE for estimating horsepower output of a motor from hook-on volt-ammeter readings.

1. Plot a chart (see illustration) with "percent hp." against "percent full-load amperes" for each motor.

2. Locate point A as 100 percent from motor nameplate reading of amperes at rated hp. of motor. (Also it is assumed that the nameplate voltage is maintained.)

3. Disconnect motor from load and read no-load amperes with ammeter and locate point C in percent of full-load current (approximately 25 to 45 percent depending on motor speed.

4. Locate point D halfway between and C and draw line DA.

5. Locate point B on line DA at 50 ercent of the motor hp. rating and raw CB.

6. Then line ABC will be the approximate curve of the percent horsepower output of the motor plotted against percent of motor current.

7. For any motor current, read in amperes, calculate the percentage of he full-load current, follow horizontally until line ABC is intersected. Then drop down vertically and read he percent load of the rated hp. of he motor.

If it is not convenient or feasible o disconnect the motor from the load s suggested in step 3, then the noload current can be taken from the hart shown. For example, an 1,800-.p.m. motor has a no-load current of pproximately 25 percent, which is he average for motors up to 100 hp. Lower speed motors have higher noload currents, in the order of 45 percent of full-load current for 600-.p.m. motors.

Magnetizing Current

It may be surprising to find that he no-load currents are as high as hown, but it should be remembered hat the no-load current is nearly all magnetizing current at practically ero lagging power factor and that he actual horsepower input from the power system is very low. This accounts for the rather high currents below one-half load, where the efficiency of the motor is also lower.

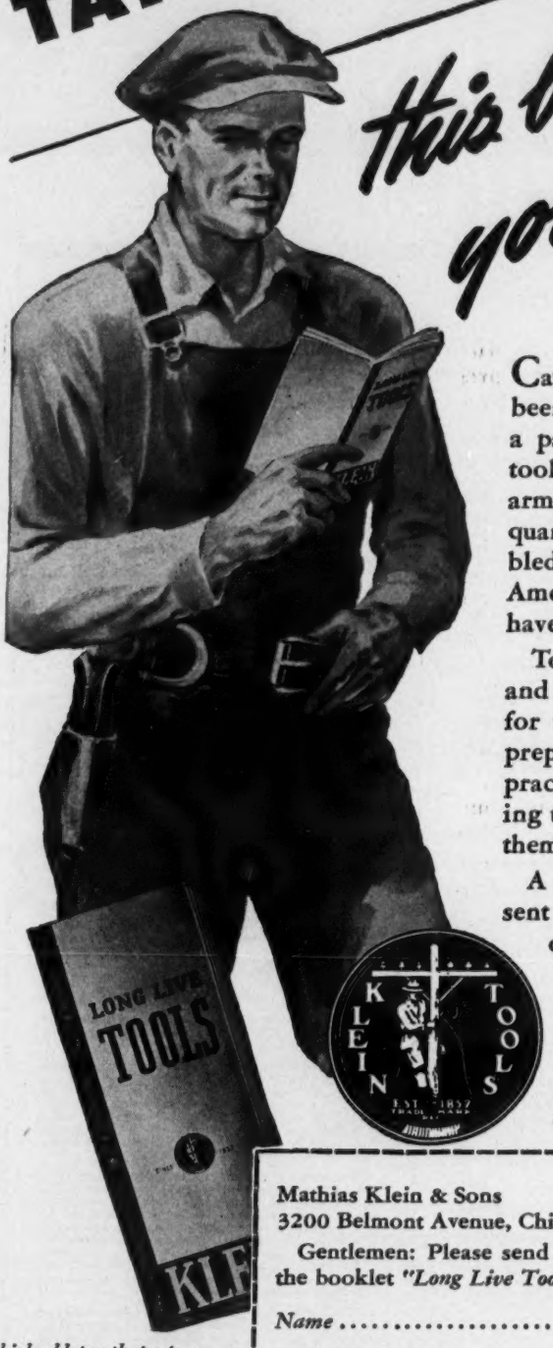
From one-half to full load it can be seen that the motor current is roughly proportional to horsepower output because both efficiency and power factor are higher and more nearly constant.

Thus we have a timely, practical and time-saving way to determine the horsepower that an a.c. motor is delivering, just from an ammeter reading. Accuracy of between 2 and 3 percent can be expected, subject, of course, to the ammeter accuracy tolerance.

Another advantage to be obtained by the hook-on voltmeter is that the voltage applied to the motor can be read simultaneously with the current. It is obvious that a motor must have the proper voltage applied or the current will be too high and overheating will result. This will also give an indication of the loads on feeder copper.

IT PAYS TO TAKE CARE OF TOOLS—

this book tells you how



Caring for tools has always been good business—now it is a patriotic duty. For it takes tools to win a war. Mechanized armies need hand tools in such quantities that even with doubled and redoubled production, American tool manufacturers have few left for use at home.

To assist linemen, electricians and other who use tools to care for their equipment, we have prepared a handbook full of practical suggestions on making tools last longer—or using them with greater safety.

A copy of this book will be sent anyone interested. It is our contribution to help lengthen the life of tools and equipment.

DISTRIBUTED THROUGH JOBBERS
***Foreign Distributors:* International Standard Electric Corp., New York**

Since 1857

This booklet on the proper care of tools and suggestions for their safe use will be sent on request to anyone interested. Mail the coupon.

Mathias Klein & Sons
3200 Belmont Avenue, Chicago, Illinois

Gentlemen: Please send me without charge a copy of the booklet *"Long Live Tools."*

Name .....

Address .....

City ..... *State* .....

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE CHICAGO

MANUFACTURERS OF LINEMEN'S TOOLS AND EQUIPMENT

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Ads Tell Public About Space Heating

These uncomfortable times, with their 65-degree house temperatures and shawl-clad shoulders, are leading many otherwise straight-thinking citizens to cast speculative eyes at their radiant electric heaters and ponder the possibilities of house heating with as yet unrationed electricity.

There are many reasons why such speculation needs intelligent guidance. Some of these reasons are being tactfully called to the attention of ration-minded Detroiters this winter in a series of common-sense advertisements of the Detroit Edison Company.

These advertisements point out: First, that radiant heaters, while fine for short-time heating of small spaces, such as bathrooms, are rather costly for home heating on a large scale or even for raising 65-degree temperatures to 70 degrees; second, that if widely adopted for space heating electric heaters of this type would require much extra generating equipment. By virtue of its short period of use each year, carrying charges on such extra capacity are not economically justified.

Objective of the series is to answer questions received from customers who are asking, "Can I heat my home with electric heaters?"

Why can't I
HEAT MY HOUSE
electrically?
People ask us — "Isn't it possible to heat *my whole house* with electricity? Why not small heaters in every room, or an electric furnace in the basement?"
In a nutshell, the answer is this: Electric heat is practical in a SMALL SPACE (such as a bathroom) for a SHORT TIME (one or two hours' use per day). But at present it is not economical for heating for long periods or for large rooms. And it is NOT an economical means of providing additional heat to raise the temperature from 65 to 70 degrees throughout your entire house. There are several reasons why this is so.
First, electric heat is highly refined heat made from coal, and a great deal of heat is lost in the process. If you had 5 tons of coal to turn into electric heat, the heat of *4 tons of coal* would be lost in the change-over, and the heat equivalent of only ONE TON would be delivered to your home. The most efficient electric power plants today can extract in the form of refined electric heat about *20 per cent* of the heat originally in the coal. But if you burn the coal in your furnace, you can extract 50 to 60 per cent of its crude heat in useful warmth.
Second, electricity must be made the instant it is being used and on cold days each home would require about 80 times as much as it uses normally. The extra power plant equipment to produce enough electricity to heat houses on a cold day would be partly idle on a warmer day; and it would be completely idle all summer. But the expense would continue the year round, and to cover this all-year expense, the cost of electricity would be high.
All the above pertains to house heating. Electricity is, of course, highly economical for steadier uses like water heating, cooking or other uses of refined heat requiring closer control.
THE DETROIT EDISON COMPANY

UTILITY ADVERTISEMENT warns customers not to misapply radiant heaters for large scale house heating

Chicago Dealers Carried On in '42

At the end of 1942 six-sevenths of Chicago's electrical dealers were still in business. Those with volume large enough to cause them to maintain service and display departments numbered about 300 at the year end. Key to survival appears to be repair business. Some 76 service shops are operating under "forced draft," with all the larger appliance firms having service departments.

Appliance stocks have disappeared from Chicago's loop, but the Commonwealth Edison Company reports that half of the 300 dealers remaining —those that replied to a recent questionnaire—reported the following available items:

Item	No. Dealers
Blankets	6
Broilers	61
Clocks	83
Coffee makers	87
Fans (desk)	64
Fans (ventilating)	23
Griddles	23
Hair dryers	29
Heaters	5
Heating pads	91
Hot plates	28
Irons	34
Ironers	41
Juice extractors	50
Mixers	47
Radios (console)	43
Radios (portable)	77
Radios (table)	84
Record players	68
Ranges	47
Refrigerators	22
Roasters	48
Sewing machines	27
Shavers	66
Sun lamps	36
Therapeutic lamps	22
Toasters, bread	71
Toasters, sandwich	59
Toy trains	39
Vacuum cleaners	85
Waffle irons	65
Washers	13
Water heaters	17
Christmas tree lights	73

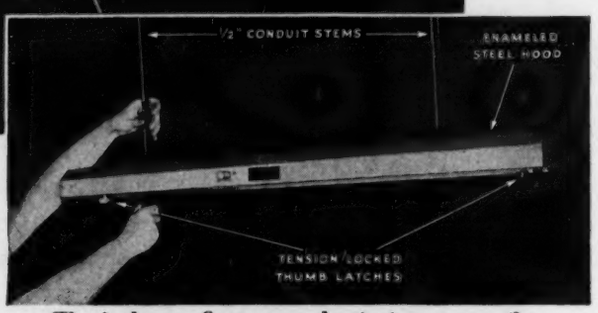
As a service to customers Common-

Westinghouse

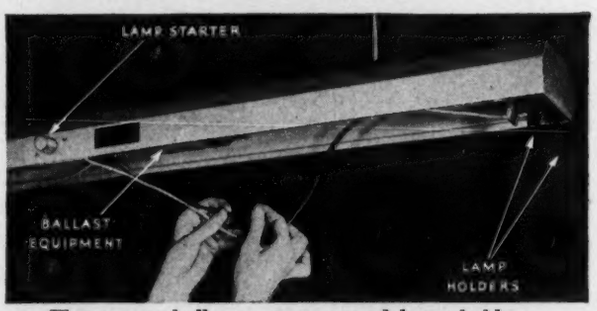
RLM NONMETALLIC REFLECTORS

provide

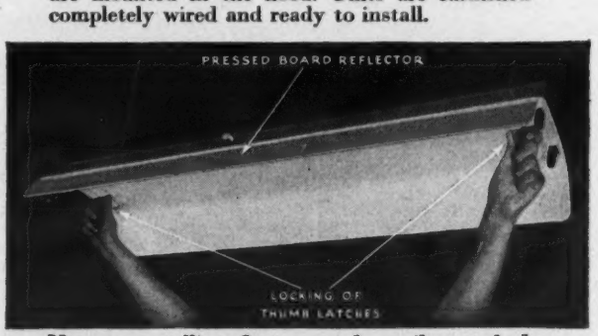
MORE LIGHT EASY MAINTENANCE



Westinghouse fluorescent luminaires are easily installed. Units are arranged for rigid conduit, flexible conduit, or chain mounting.



Fluorescent ballasts, starters, and lamp holders are mounted in the hood. Units are furnished completely wired and ready to install.



New nonmetallic reflectors can be easily attached or detached. Units are approved by the RLM Standards Institute, and are so labeled.

For the want of steel—new nonmetallic fluorescent reflectors have been developed which give more light for 'round-the-clock war production and provide easy maintenance. They're the new Westinghouse pressed reflector-board reflectors—for 40-watt and 100-watt luminaires and for continuous-strip installations.

These easily detachable reflectors are interchangeable with previously installed equipment. There's neither wasted time nor effort in installation or servicing. Their durable, high-reflectivity finish resists scratching and chipping and is repellent to industrial acids and fumes.

Nonmetallic reflectors are further examples of Westinghouse engineered seeing—the ability to adapt lighting to present-day war needs. For complete information, just write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio, and ask for Folder B-3190.

117 Westinghouse Electric Supply Company Offices and Independent Westinghouse Lighting Distributors provide local stocks and services.

Plants In 25 Cities—Offices Everywhere.

Westinghouse

LIGHTING EQUIPMENT

A Year of "Retail-Minded" Action in Wartime!

The record tells the story of Kelvinator's never-ending service to refrigerator retailers

True "retail-minded" thinking never stops . . . *even when production is devoted 100% to all-important war work.*

At Kelvinator, it is not only a way of doing business in peacetime, but a philosophy for all time.

Thus, Kelvinator has never for a moment forgotten its obligations and its responsibilities to retailers and to the entire refrigeration industry.

Tangible evidence of this is found in the following report of Kelvinator's "retail-minded" activities since that famous day in February when the sale of refrigerators was frozen. It is significant that they could be conceived and properly timed *only with the consistent and close daily contact Kelvinator factory and field men have maintained with retailers during the past twelve months.*

1 Information Service on Government Regulations

From the day refrigerators were frozen, Kelvinator has transmitted government regulations immediately and in full to *all* Kelvinator retailers as soon as issued. These mailings, which have involved the printing and distribution of over 300,000 pages of material, have kept every Kelvinator retailer abreast of government rulings and regulations *affecting his Kelvinator business. This* is "retail-minded" action in wartime!

2 Definite Statement of War and Post-War Policies

Last year and long before post-war thinking became the order of the day, Kelvinator issued its brochure, "Looking Ahead with Kelvinator," in which it definitely stated its position, its philosophy, its "retail-minded" policies and its over-all program for the war and post-war periods. This gave refrigerator retailers a clear understanding of *one* company's future thinking . . . gave them something on which they could base their own future plans. *This* is "retail-minded" action in wartime!

3 Wartime Advertising Lays Post-War Foundation for Continuing Sales Increases

Looking ahead, Kelvinator knew that post-war dealer sales and profits could be favorably affected by the increased acceptance of individual company names and pubic recognition of wartime leadership. Kelvinator, therefore, launched a consistent national advertising campaign to inform the public of its vital rôle in war production, to help build public morale, to enhance the name of Kelvinator and to assure the continuance of Kelvinator's dominant sales gains. Already this program is recognized as outstanding by public officials, consumers, and retailers alike. *This* is "retail-minded" action in wartime!

4 Simplified Service Training Course for the Entire Industry

Seeing the retailer's problem of maintaining a service organization grow increasingly important, yet day by day more difficult, Kelvinator published a timely "Simplified Training Course for Refrigerator Service Men" for *all* makes of refrigerators. Developed for either individual use or classroom instruction and made available to *all* dealers and utilities, its wide use has been gratifying proof of its service to the industry. Over 15,000 copies are already in use. *This* is "retail-minded" action in wartime!

5 Complete Service and Parts Facilities Maintained

Recognizing the importance of maintaining and conserving the nation's present equipment, Kelvinator's field service organization has been kept intact at efficient peacetime levels. The same number of service contacts are being made and the same number of parts depots are being maintained for prompt service on all parts. *This* is "retail-minded" action in wartime!

6 New Book on Manpower Regulations Now Being Released

This publication, available to all refrigerator retailers regardless of make handled, details government regulations on manpower and interprets these regulations as they affect retail service setups. With its aid, and in cooperation with the local Selective Service officials, the retailer will be in a better position to work out a solution to his service manpower problem. *This* is "retail-minded" action in wartime!

7 From Kelvinator's Plants Now Devoted 100% to War Will Come the Refrigerator of the Future

Kelvinator is proud of its 12-month record of uninterrupted "retail-minded" action in wartime. And prouder still that while rendering this full aid and assistance to retailers and the industry as a whole, its plants were devoted 100% to war . . . producing on schedule intricate Hamilton Standard propellers for United Nations bombers and 2,000 H.P. Pratt & Whitney engines for the Navy's mighty *Corsair* fighter, as well as other ordnance items important to winning the war. For this is our war task!

But, when peace comes, retailers again can expect from Kelvinator the most modern refrigerator . . . the soundest franchise . . . and the finest profit opportunity in the industry.

8 Kelvinator Has Kept in Touch

It is a matter of record that Kelvinator factory and field men have continued to maintain close and friendly relations with retailers everywhere through regular, scheduled calls during the past 12 months. Through these contacts, we have kept abreast of the retailers' vital wartime needs and problems. Kelvinator likewise continued its close contacts with furniture and department store people and is proud to have been able to show important items of its war production to over 15,000 of them at the American Furniture Mart in Chicago during January.

The valuable assistance given us by the retailers themselves through these regular contacts made possible this helpful program of "retail-minded" action in wartime! And the many expressions of appreciation justify our determination to make the future one of equally outstanding service.

TOP EFFICIENCY with RLM Non-Metallic Reflectors!

Typical Wheeler convenience! Quick, easy access to operating parts by loosening two thumb-screws. Exclusive chain hangers support detached reflector. No loose screws, bolts or nuts to handle.

New "War-Aid" Fixtures insure availability of Wheeler SKILLED LIGHTING for war plants!

In spite of wartime metal scarcity, you can obtain fluorescent lighting fixtures with all the lighting efficiency and convenience of pre-war Wheeler "Skilled Lighting" units. Wheeler's 60 years' experience in better lighting has now produced top-standard "War-Aid" models requiring minimum metal!

Reflectors of "War-Aid" units are rugged non-metallic material. Non-flammable, moisture-resistant. Reflecting surfaces of chip-proof, washable baked enamel provide minimum efficiency of 80% in 48" 2-lamp units; 73% in 3-lamp units; and 73% in 60" 2-lamp units. Available for individual or continuous-run installations.

Write for full details of Wheeler "War-Aid" Fixtures and catalog of Incandescent Fixtures. **Wheeler Reflector Company, 275 Congress Street, Boston, Massachusetts.** New York . . Cleveland. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

wealth Edison is acting as a clearing house on available appliances. Chicagoans seeking appliances no longer in utility stock are given the names of dealers who have them for sale.

As might be expected appliance sales in Chicago slumped in 1942. Approximate idea of 1942 retail sales as compared with 1941 can be had from the following:

	Units 1941	Units 1942
Chimes	8,100	8,000
Cleaners	63,500	37,000
Clocks	152,000	75,000
Coffee makers	160,000	105,000
Fans	97,250	66,000
Flashlights	325,000	330,000
Heating pads	82,600	41,000
Ironers	5,000	1,600
Lamps, I.E.S.	96,700	32,000
Others	250,000	167,000
Mixers	44,500	27,000
Oil burners, heaters	14,150	1,000
Radios	186,300	150,000
Ranges	6,500	2,000
Refrigerators	112,500	22,500
Toasters	200,000	150,000
Waffle Irons	78,300	55,000
Washers	51,400	20,000
Shavers	95,000	68,000
Irons	225,000	157,000

Replacements on refrigerators by Chicago dealers were considered to be 25 percent of all sales; washers and cleaners about 75 percent. Repair of these items, plus service and maintenance, now that new merchandise is difficult to get, is expected to keep the pot boiling in 1943.

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Training Program for Power Salesmen*

By JOHN T. KIMBALL
Sales Promotion Manager
Mississippi Power & Light Company

Helping customers to arrive at efficient solutions of problems of war and essential civilian production can be a large contribution by electric utilities to the preservation during and after the war of the American system of creative business and of themselves as business enterprises. Here is how the Mississippi Power & Light Company is working to that end in an organized plan.

A company power consultant was called on for help in a problem that had stumped the operating men of a hosiery mill. The power man solved the problem and then looked around to see if there was anything else he could do to improve production and to reduce cost. He made a complete survey and found several opportunities to help the customer. By this

*From paper to Southeastern Electric Exchange.

Regardless of Surrounding Temperature

THE THERMALOAD V

SOLENOID STARTER

Always Trips at the Same Overload

When specifying a motor starter, it is important to remember that the performance of the new Monitor Thermaload V Solenoid Starter is unaffected by extremes in ambient temperature. The exclusive Monitor Compensated Thermal Overload Relay . . . a time-proved feature of large Monitor controls . . . gives you assurance that the trip will always occur within a given time at the same percentage of overload. That's the kind of protection you need for your almost irreplaceable motors . . . the kind of protection that slashes motor maintenance costs . . . keeps production UP!

Supplementing this important feature, the Thermaload V offers these additional advantages . . . Vertical, Straight-Line Design; Resilient, Shock-Proof Mounting; Double-Break, Silver Contacts; Interchangeable Coils for different voltages; Tamper-Proof Re-Set Protection; Ready Accessibility of all parts. Supplied fully enclosed or without enclosure for panel mounting.

Write for complete details and delivery dates or see the Monitor field engineer in your territory.

● SMALL OVERALL DIMENSIONS . . . indicate a better design . . . permit installation in smaller spaces. Available in four sizes . . . 1.5 to 7.5 H.P. . . . 110 to 550 volts (A.C.) . . . all fully approved by Underwriters' Laboratory.

TheMonitorControllerCompany

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

RE-LIGHTING

the new manpower / production *requirement*

Vital to plants built and lighted for daylight operation

Most plants operating today were designed and built for peacetime, *daylight* working schedules. Wartime production demands night work. *Lighting based on daylight conditions is inadequate to serve the needs of night workers.*

Night production is generally acknowledged to be anywhere from 20% to 40% less efficient than daytime production. And poor lighting, with its consequent eyestrain, fatigue, and lower working efficiency, is a major cause of this slump.

Re-lighting for 24-hour-a-day war production is the easiest, most economical remedy for this condition. Re-lighting does not mean discarding your present lighting system. It merely means bringing the equipment you have up to date by relocating lamps to eliminate glare and shadow; increasing lamp wattages, re-spacing lamps, installing additional equipment to insure uniform lighting levels throughout your plant. A Silv-A-King lighting engineer can tell you exactly.

Silv-A-King's part in the war effort includes the production of parts for torpedoes, bombs, gliders and other aircraft; as well as naval and surgical equipment.

BRIGHT LIGHT REFLECTOR COMPANY, INC.
1035 Metropolitan Avenue, Brooklyn, N. Y.

Send for your copy of our 16-page book: "Light Is An Essential Production Tool"

SILV-A-KING MAKES *Light* WORK FOR YOU

case the need was emphasized for a planned program of training power consultants, some of them new and inexperienced, in finding and correcting conditions causing production inefficiency in customers' plants. Such a program was developed by B. M. Davis, industrial sales manager of the company.

A two-day meeting of power salesmen was held and various types of plants were discussed where surveys had been made or should be made, such as woodworking plants, government projects, ice plants, municipal services, laundries, cottonseed oil mills, garment plants and creameries.

Plans for Surveys

Experiences of men who had done such survey work were presented along with flow charts of production and results obtained from them. Plans were made to survey all plants in company territory, beginning with those with war contracts to secure more efficient use of company services, to improve plant productions and to promote scheduled maintenance of equipment. An outline of suggestions for carrying on work was prepared and presented. A book of actual results already secured and used in the training program was prepared and given to the men for a guide in their work.

Results so far obtained are typified in the following cases:

No. 1. Woodworking Plant—The regular MP&L power-survey procedure was used. Three immediate savings were effected and another was realized when expansion became necessary in the plant. The savings were reduction in power losses, improved operating efficiency, reduced costs and reduced investment in power equipment when expansion was made.

No. 2. Garment Factory—Here again the standard power survey procedure was employed. The check-up revealed that the main driving motor could be replaced by a smaller one, and at the same time increase the efficiency of the power used. This was done. Power savings in net dollars resulted immediately. More than two dozen heater and blower units had their starting schedules staggered to lower the demand considerably. Other work processes were studied which resulted in more staggering and more savings in power utilization.

No. 3. Cotton Seed Oil Mill—The

more than

2,000,000 kw

serving war industries

ignitron power conversion proved in war production

Early in the peaceful 1930's Westinghouse introduced the Ignitron Rectifier—the new power conversion unit with no moving parts. Today, more than 2,000,000 kw installed in the electrochemical, steel, mining, transportation and other industries is serving to speed war production. No other method of power conversion has ever enjoyed an expansion as rapid as this electronic equipment. And there are good reasons why.

The Ignitron delivers high efficiency over the entire load range—high short-time overloads, constant 24-hour loads, or light loads.

Its operating costs are low. Operation is simple and automatic. There's no high starting demand.

Maintenance, too, is at a minimum. There are no major moving parts that require periodic replacement.

Costs are further reduced through ease of installation. No special foundations are required. Lightweight construction and vibrationless operation permit installation on any concrete floor of reasonable strength.

If you need d-c power conversion, investigate these and other advantages of the Ignitron Rectifier. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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for war industries using d-c power

Ignitron power conversion can eliminate many production "headaches" for war plants. Completely automatic, it can operate unattended. And because there are no major moving parts to wear and replace, inspection, repair and maintenance are cut to a minimum. Valuable production hours are saved. Ignitrons are always on the job—delivering service 24 hours a day.

For more complete information about Ignitron power conversion, write Dept. 7-N today, for a copy of Book B-3024.

J-10242-4

Westinghouse

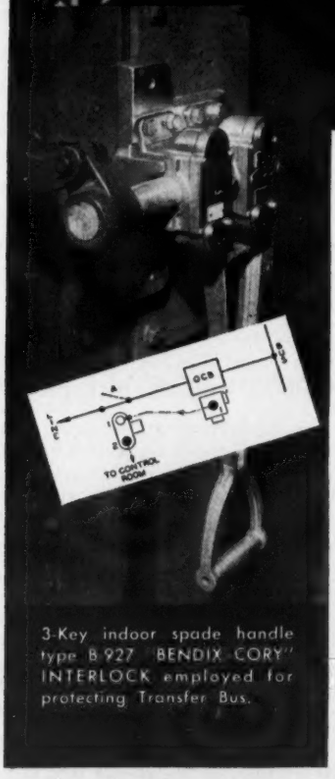
Electronics at Work

ON RECTIFIERS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Does YOUR Switch Room employ an

INVISIBLE CREW?



3-Key indoor spade handle type B 927 BENDIX CORY" INTERLOCK employed for protecting Transfer Bus.

SAFEGUARDING the lives of your Switch Room Crew has always been important. Today, with men *and* equipment irreplaceable, certain protection for *both* becomes imperative.

How secure such protection? Put "BENDIX-CORY" INTERLOCKS to work. These important members of the Bendix "Invisible Crew" *eliminate* fatal errors . . . *prevent* access to, and use of, high voltage equipment until proper precautions have been taken.

Note the application of "BENDIX-CORY" INTERLOCKS illustrated . . . it is one of hundreds of different adaptations which might well be employed in your plant. Write today for full information and suggestions on various Interlock systems of protection.

MARINE DIVISION
One Hanson Place, Brooklyn, N. Y.

Products of the Marine Division are important members of "The Invisible Crew" — precision instruments and controls which 25 Bendix plants from coast to coast are speeding to world battlefronts.

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

obvious power losses in such an operation result from lineshaft friction and the misapplications of motors. The survey revealed where savings could be made and they were made. The monthly accruals of saved power dollars in such cases are substantial because power cost in these mills represents a sizable part of the operating cost.

•

"Meterettes" Serve As Meter Readers

Another field of men's peacetime activities has been opened to the women. Young ladies have taken over the responsibilities of meter reading. The counterpart of meter readers for the Northern Indiana Public Service Company, Hammond, Ind., are known as "Meterettes." These girls are attractively attired in

METERETTES have been schooled for meter reading

smart navy blue cadet uniforms and matching overseas cap trimmed with gold braid.

Before being sent out to read meters, the young women are given special instructions in the function and correct reading of the instruments, as well as being trained in other duties connected with this branch of the service.

The meterettes replace men as they are called into the armed forces and in performing a man's job are making a valuable contribution to the war effort.

The day the metal works went out of business

There was plenty of time to save the plant . . . even after the flames caught the edge of that puddle of oil.

But someone hit the blaze with a water stream. Ten minutes later you could see the flames all over town.

In your shop you should have men who can handle extinguishers . . . who can pick the *right* one when fire strikes. Training provides the answer. *The best training is a well-run demonstration, where men see extinguishers in action, learn how to use them.*

Walter Kidde & Company is preparing a booklet—"How to Teach Fire-Fighting." It tells how to handle demonstrations effectively, how to set up fire tests, how to explain extinguisher action. Write now. We'll mail you a copy.

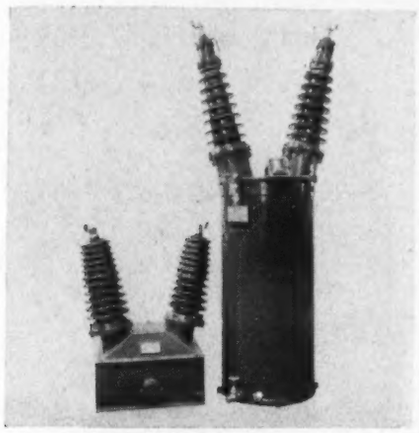
Walter Kidde & Company, Inc.
328 West Street **Bloomfield, N. J.**

Kidde
HIGH PRESSURE GASES • FIRE PROTECTION
PROTECTS LIVES

NEW EQUIPMENT

Transformers

New line of two-bushing potential transformers (which supersede the type E-116) are said to have a reduction in height of 15 to 50 percent, in weight 10 to 60 percent, and in liquid volume 45 to 90 percent, depending on the rating of the transformer. These reductions mean that the units can be mounted up in the substation structure, thereby simplifying primary connections, saving ground space and eliminating need for constructing a separate foundation. Transformers can be filled with either Pyranol or oil, have no gaskets, are hermetically sealed, have all-welded steel tank and sealed-in-glass secondary terminals.



Type E-236 outdoor potential transformers; rated 24 to 69 kv., 50/60 cycles. (Illustration—a comparison of 69-kv. units, types E-236 (left) and E-116.) **General Electric Co.**, Schenectady, N. Y.

•

Rubber Mountings

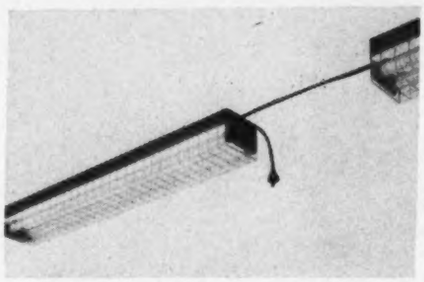
Vibro-Insulators; synthetic rubber mountings. **B. F. Goodrich Co.**, Akron, Ohio.

Line of mountings can be made using Ameripol synthetic rubber; are designed to carry the load in shear; formerly were made of natural rubber bonded to metal, used for isolation and insulation of vibration, shock and noise.

•

Lighting Unit

Double-circuit mechanic's light has receptacles for plugging in small power tools and additional fixtures. As many as four lights can be connected in line to a maximum of 60 ft. from a single outlet, according to the manufacturer. Brackets for hanging and a hinged wire lamp guard are standard equipment.



Mechanic's light; 24-in. unit has two 20-watt lamps and 48-in. unit has two 40-watt lamps, for either 50- or 60-cycle circuits of standard voltages. **Lumidor Manufacturing Co.**, 3120 East Pico Blvd., Los Angeles, Calif.

•

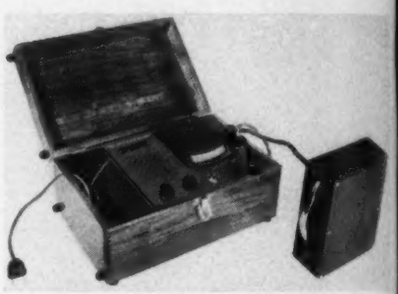
Relay

Electro-pneumatic time delay relay for making or breaking electrical circuits at predetermined intervals has been redesigned and has a single-screw adjustment, said to permit a delay ranging from a fraction of a second to several minutes. The diaphragm-type timing device is unaffected by heat, cold or variations in operating voltage, temperature or humidity, it is claimed.

"Agastat" time delay relay. **American Gas Accumulator Co.**, Elizabeth, N. J.

Glossmeter

Portable glossmeter has an indicating instrument with a photocell and taut-wire suspension galvanometer for measuring specular gloss. Search unit, connected by flexible cable to instrument, can be furnished for 45, 60, 75 deg. gloss or other angles. Unit is first standardized to give a reading of 92.5 for polished black glass; then search unit is placed on the sample and the needle indicates directly the gloss in terms of an ideal completely reflecting mirror as 1000. Measurements of specular and diffused reflectance can be carried out with the same instrument, using two different search units.



Photoelectric glossmeter; Model 650 operated by dry-cell batteries bound in instrument case; model 660 for operation from 105-125 volts, 50-60 cycles a.c. and also from a storage battery. **Photovolt Corp.**, 95 Madison Ave., New York, N. Y.

•

Identification Badge

"Plasticseal" badge; 1/8-in. thick; two types of clasps—spring pin type and safety catch. **Royal Emblem Co.**, 41 John St., New York, N. Y.

Plastic identification badge for industrial or utility workers is said to be non-burning, non-magnetic and completely tamper-proof. Laminated construction of the component parts being integrated, any attempt to take the badge apart would mutilate the parts beyond use. No special tools are required for assembly.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

KEEP THIS MAN IN MIND!

He will be knocking on your door with added emphasis when victory is ours. At present, he is doing his best to serve you in spite of a scarcity of materials, an all-out effort on war production and reduced traveling facilities. Some day, these contributions will have proved that they were not in vain, and his familiar voice will have a new and light-hearted tone as he greets you with the latest developments that have been accumulating in the Hubbard Research and Development Department.

For he is a Hubbard Sales Engineer, ready and willing to help you with your present problems, within the scope of war-time limitations. *His* mind is on the application of new Hubbard products to your future operation. Keep him in *your* mind.

HUBBARD AND COMPANY

PITTSBURGH ... OAKLAND ... CALIFORNIA ... CHICAGO

1¼ MINUTES READING TIME

OSMOPLASTIC

PROTECTS YOUR POLES FROM GROUNDLINE DECAY

Here's How:

1 Dig earth from around pole to a depth of about 14 inches from groundline. Then remove loose decayed wood in the treatable zone.

2 Apply OSMOPLASTIC by brushing or daubing on the cleaned surface from 6 inches above to 12 inches below the groundline level.

3 Wrap Osmose bandage around treated area. This protects and retains the Osmoplastic until the Osmosalts penetrate into pole.

4 Back-fill the hole and the operation is completed. The Osmoplastic protection adds many extra years service to standing poles.

Osmose Wood Preserving Company of America, Inc. Dept. W
1437 Bailey Avenue, Buffalo, N. Y.

Please send me the new Osmoplastic Bulletin on groundline treating utility poles for *extra* years of service life.

Name_____

Address_____

City and State_____

OSMOSE
WOOD PRESERVING
COMPANY of AMERICA, Inc.
BUFFALO, N. Y.
DENVER CHICAGO NEW YORK
KENOVA, W. VA.

TECHNICAL LITERATU

BIBLIOGRAPHY ON AUTOMATIC STATI by A.I.E.E. Committee. Copy available 50 cents from American Institute of E trical Engineers, 33 West 39th Street, York, N. Y. Contains over 700 entries ering supervisory control, telemeter automatic switchgear, combustion con automatic hydro-electric plants, autom substations.

STEAM HOSE—Rules for the care maintenance of steam hose, detailed structions on the proper methods to att couplings, as well as data on diamet weights, and plies, are contained in a c logue section 4500, "Steam Hose," wh is available from the B. F. Goodrich C Akron, Ohio.

PLASTICS—Manual outlines functions contains specifications, properties and plications of various forms and shapes cellulose plastics such as Lumarith Celluloid. The publication, "Cellulose P tics in War and Industry," can be obtai from Celanese Celluloid Corp., 180 Ma son Ave., New York, N. Y., when requ is made on your company's letterhead.

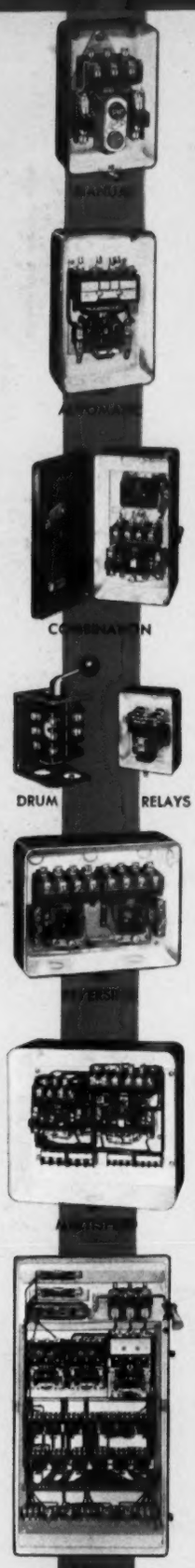
ELECTRICAL HEATING ALLOYS—"A.S.T Standards on Electrical Heating and R sistance Alloys" provides 23 specificati and tests on electrical-heating materi electrical-resistance materials, thermo metals, materials for lamps and ra tubes and structural and electrical resi materials for furnaces. The 160-page p lication, single copy price $1.50, is av able from American Society for Testi Materials, 260 South Broad St., Philad phia, Pa.

ARC WELDING—Standards for weldi electrodes and electric arc-welding paratus such as d.c. and a.c. generat dynamotors, transformers, motor-generat sets, d.c. arc-rectifier units and resistors included in publication No. 44-81, obta able from National Electrical Manufact ers Association, 155 East 44th St., N York, N. Y.; price 75 cents per copy.

PLASTICS—Physical and electrical pr erties of three series of resin compou also tabulated applications and specific a vantages of wire and cable insulated wi Vinylite, are presented in a booklet "Vin lite Wire and Cable Insulation Plastic which is made available by Halowax Pro ucts Division, Union Carbide & Carb Corp., 30 East 42d St., New York, N. Y.

RESISTANCE ALLOYS — Properties metals and alloys, resistance, tables, te perature resistance charts, current tempe ture characteristics, heating element da and other technical data on various allo are contained in "Data Book on Electric Heat and Corrosion Resisting Alloys Copy of the data book may be obtain from Driver-Harris Co., Harrison, N. J.

THERMOMETERS—A 12-page booklet d cusses the operating principle of the mometers and gives information for s lection of the instrument, bulb and cap lary and armor. A table gives properties vapor-pressure and gas-filled instrumen Copy of Bulletin G23-2 may be obtain from Wheelco Instruments Co., Harris and Peoria Sts., Chicago, Ill.



There is an

ALLEN-BRADLEY CONTROL

for every operating requirement

Allen-Bradley Bulletin 709 solenoid starter—open type construction.

The heart of the Allen-Bradley line is the A-B solenoid switch. Its accurate and instantaneous response to pilot controls and its amazing record of lifetime service without contact maintenance are giving machinery builders valuable opportunities for stepping up machine outputs.

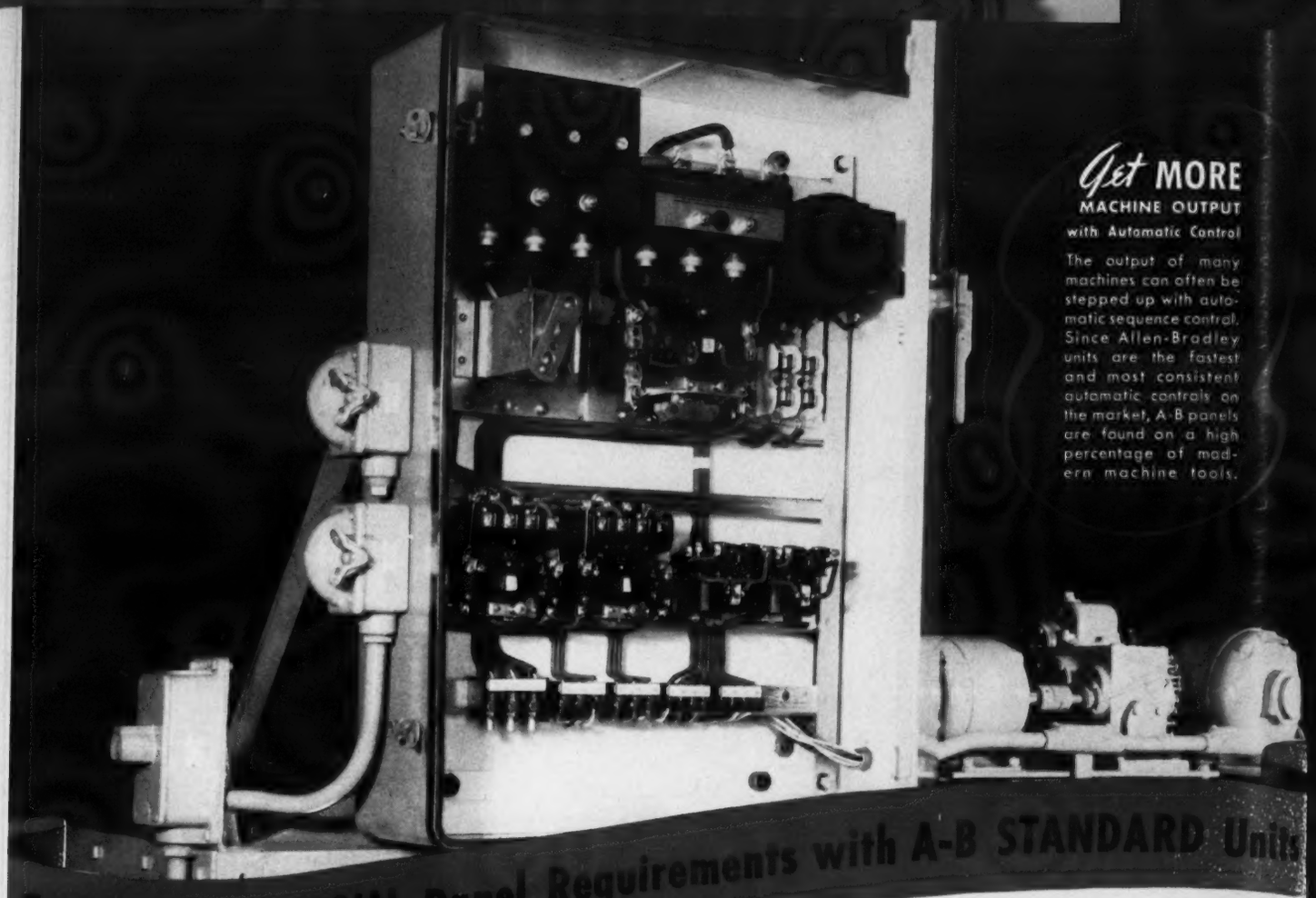
Allen-Bradley solenoid controls are available in an exceptional variety of standardized types, ratings, and enclosures. With standard A-B units you can solve practically any special control requirement. Send for "The Story of the Solenoid Starter"... and read how modern control can serve you.

A-B SILVER ALLOY, DOUBLE BREAK CONTACTS NEVER NEED CLEANING

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

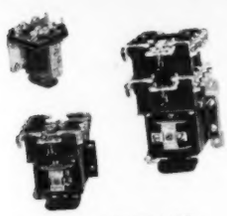
QUALITY



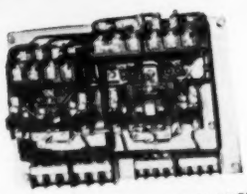
Get MORE MACHINE OUTPUT with Automatic Control

The output of many machines can often be stepped up with automatic sequence control. Since Allen-Bradley units are the fastest and most consistent automatic controls on the market, A-B panels are found on a high percentage of modern machine tools.

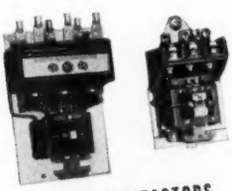
Satisfy Your SPECIAL Panel Requirements with A-B STANDARD Units



SMALL CONTACTORS

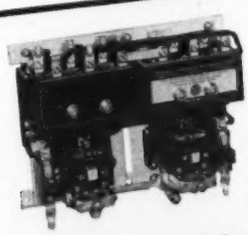


MULTI-SPEED MOTOR STARTERS

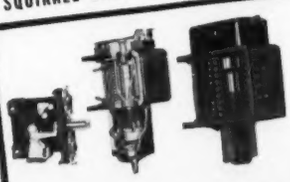


LARGE CONTACTORS

SQUIRREL CAGE MOTOR STARTERS



REVERSING SWITCHES



OVERLOAD and TIMING RELAYS

If your machines perform a definite sequence of operations, you can probably save critical materials by combining your control units on one control panel.

Special control panels need not mean special control units because Allen-Bradley engineers are constantly assembling intricate special panels using only standard units listed in the Allen-Bradley catalog.

The A-B line consists of such a wide assortment of contactors, relays, switches, disconnects, and starting units of all sizes and types that it is a simple matter to develop complex control panels entirely of time-tested, reliable A-B units.

Don't risk the dependability of your machines by using "trick" control panels. Standardize on A-B panels. Then you will be safe . . . and save critical materials, too.

Allen-Bradley Company, 1327 S. First St., Milwaukee, Wis.

ALLEN-BRADLEY

AUTOMATIC MOTOR CONTROL

NEWS ABOUT PEOPLE

eph Slepian Awarded A.I.E.E. Lamme Medal

he 1942 Lamme Medal of the Ameri- Institute of Electrical Engineers been awarded to Dr. Joseph Sle- n, associate director of research, stinghouse Electric & Manufacturing East Pittsburgh, Pa., "for his con- utions to the development of cir- -interrupting and current-rectifying aratus." The medal and certificate be presented to him at the Na- al Technical Meeting of the insti- e, to be held in Cleveland June 21-25. Dr. Slepian has specialized particu- y in the development of electrical aratus involving arc phenomena and made some of his major scientific engineering contributions in con- tion with the development of auto- ve lightning arresters, Deïon circuit

akers, high-voltage fuses, ignitrons d mercury-arc rectifiers.

A native of Boston, Mass., and a duate of Harvard University, Dr. pian spent a year in study abroad at University in Gottingen and at the bonne in Paris. Returning to this ntry, he taught mathematics at Cor- l University, 1914-15, and then entered the student course given by Westinghouse. Since 1916 he has been a member of the staff of the research laboratories and in addition has rendered valuable services as a consultant to the engineering departments of the company.

He has written many scientific and engineering papers which appeared in the journals of the American Mathematical Society, American Physical Society, American Electrochemical Society, American Institute of Electrical Engineers and in other publications. He is a member of the societies mentioned above and also of the American Association for the Advancement of Science.

•

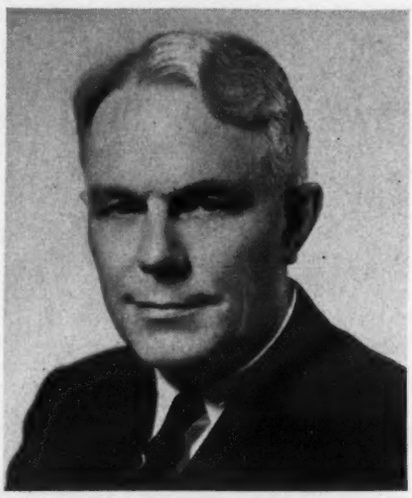
▶ PHILIP L. THOMSON, director of public relations, Western Electric Co., and prominent in advertising and publishing fields, observed his fortieth anniversary with that company on February 23. A long-time worker for the betterment of the advertising industry, Mr. Thomson was elected president of the Association of National Advertisers in 1923 and of the Audit Bureau of Circulation in 1927, a position he still holds after serving sixteen terms in that office.

▶ EDGAR S. HAYMOND has been elected treasurer of the West Penn Power Co., Pittsburgh, Pa., following the resignation of W. R. HINCHMAN, who recently joined Miller & Van Winkle, Inc., Paterson, N. J. Mr. Haymond has been in West Penn's employ since 1915, with the exception of a year's service in World War I. He will also serve as treasurer of West Penn Railways Co., Allegheny Pittsburgh Coal Co., Ohio County Fuel Co., West Penn West Virginia Water Power Co., Windsor Coal Co. and Windsor Power House Coal Co., and continues his duties as treasurer of the Potomac Transmission Co., West Virginia Power & Transmission Co. and West Penn Securities Department, Inc.

Coast Counties Utility Promotes H. W. Edmund

Harvey W. Edmund has been elected vice-president and general manager of Coast Counties Gas & Electric Co. and a member of the utility's board of directors.

Mr. Edmund had been sales manager



for Coast Counties for nine years, and previous to that had been general sales manager for Standard Management & Operating Corp., which directs the affairs of Coast Counties.

A graduate in engineering from the University of Wisconsin, Mr. Edmund was associated for six years with Western United Gas & Electric Co., at Aurora, Ill.; spent two years in the Army Air Corps during the First World War, and for a time was in the gas stove manufacturing business. He transferred his interest to California in 1931 to work for Standard Management & Operating Corp.

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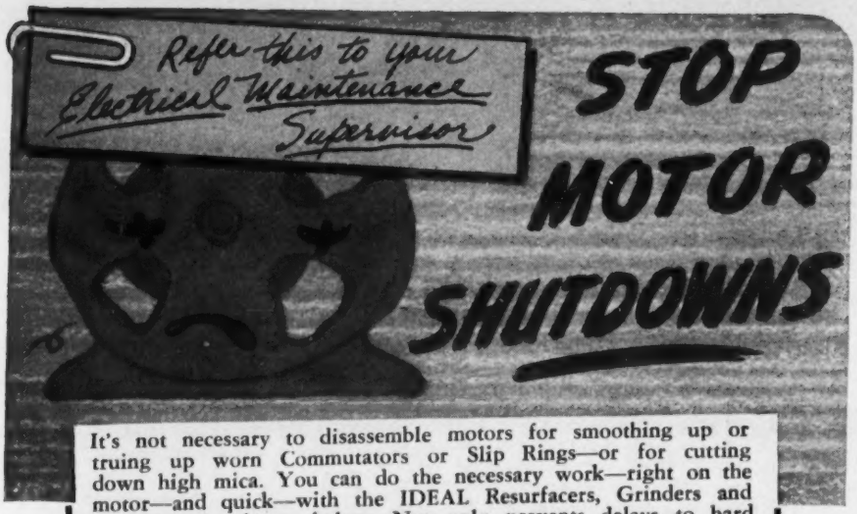
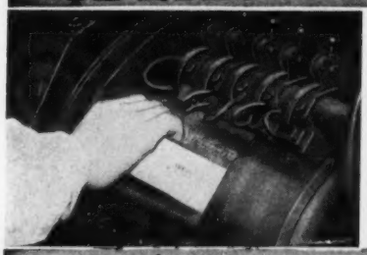
▶ C. E. WEBB has been elected to the council of the Engineering Institute of Canada as representative of the Van-



It's not necessary to disassemble motors for smoothing up or truing up worn Commutators or Slip Rings—or for cutting down high mica. You can do the necessary work—right on the motor—and quick—with the IDEAL Resurfacers, Grinders and Undercutters shown below. Not only prevents delays to hard working production lines, now, when production is so vital, but cuts motor maintenance cost at any time.

IDEAL Commutator Cleaning Stone



Quickly Removes Excess Film

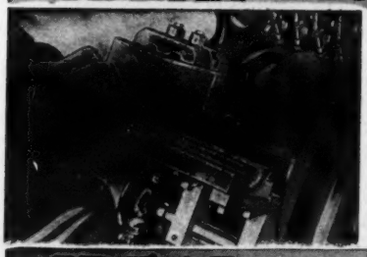
Inexpensive—you can't afford to be without it! A few seconds application periodically cleans away excessive deposits of dirt or brush material caused by heavy and continuous power loads. Doesn't cut commutator; doesn't clog. Helps to seat brushes as it cleans, increasing brush life. 5 sizes.

IDEAL Resurfacers

Keep Motors On The Job, WITHOUT DISMANTLING

Quick, easy way to periodically smooth up Commutators and Slip Rings. Refinish to a smooth, highly polished surface in own bearings. No dismantling; no production delays. Use IDEAL Resurfacers periodically to keep Commutators and Slip Rings like new—eliminate production delays! Over 175 Styles and sizes.

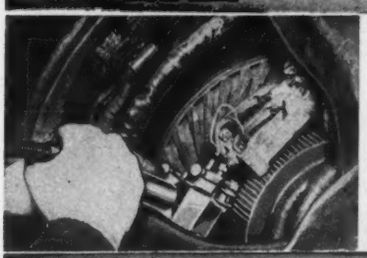
IDEAL Precision Grinders



True Up Commutators and Slip Rings In Their Own Bearings

If your Commutators and Slip Rings are badly grooved, scored, or out of round, this is the easy way to restore them to original efficiency, WITHOUT DISMANTLING. Mounts directly on the brush arms or frame; grinding is done at normal operating speeds under the machine's own power. 3 models.

IDEAL Mica Undercutters



For Undercutting High Mica

IDEAL Undercutters cut the hardest mica. Three Models: (1.) "Direct Drive", small, handy unit that undercuts without removing a single brush; (2.) "Universal", smallest, most powerful undercutter on the market; (3.) "Shop Model", for large commutators.

Write for Literature on Complete Motor Maintenance Line.

IDEAL COMMUTATOR DRESSER CO.
1021 Park Avenue Sycamore, Ill.
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd. Montreal, Quebec

couver branch. Mr. Webb joined the staff of the Department of the Interior which later became known as the department of mines and resources of the Dominion Government in 1913, and is now district chief engineer for British Columbia of the Dominion Water Power and Hydraulic Bureau. In 1940 Mr. Webb was chairman of the Vancouver branch of the institute.

H. B. Robinson Assumes New Executive Duties

H. B. Robinson, manager of the engineering and operating department of the Carolina Power & Light Co., Raleigh, N. C., has been elected a vice-president of the company. In announcing Mr. Robinson's election L. V. Sutton, president of the company, said: "It was my pleasure to recommend to the directors that Robinson be elected as an officer of the company in the capacity of vice-president. The recommendation was based upon his years of experience and the efficient manner in which he has discharged the responsibilities of his department."

Mr. Robinson joined Carolina Power & Light in 1925 as a relay engineer and held various positions in the engineering and operating department until 1938, when he became its manager. His department is responsible for system planning and design, and construction of all company electrical facilities, as well as the operation and maintenance of its generating stations and transmission system.

Mr. Robinson was graduated from North Carolina State College and then pursued his studies in electrical engineering at the Massachusetts Institute of Technology. After completing his education, and before his final return to Raleigh, he held important electrical engineering and operating positions

ROCKBESTOS A.V.C.

Provides a SURE CURE FOR WIRE FAILURES

Rockbestos A.V.C. Permanent Insulation Eliminates Repeated Wire Replacement

1. A tough, rugged, asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Inner felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to a copper-melting arc.
5. Conductor perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos

WON'T bake brittle, bloom, burn or rot
RESISTS moisture, oil, grease and fumes

Experience in countless industrial plants shows that wire failures seldom occur when Rockbestos A.V.C. is used in electrical circuits around boilers, soaking pits, furnaces, rheostats, and other troublesome "hot-spot" installations. The reason why Rockbestos A.V.C. stands up, when other wires fail, is the *permanent asbestos insulation* that won't burn, bake brittle, crack, rot, bloom or swell . . . and resists heat, corrosive fumes, oil, grease and moisture. Cure wire failures in your plant by installing Rockbestos A.V.C. in "hot-spot" circuits.

Rockbestos A.V.C. Power Cable (illustrated), Motor Lead Cable and Lighting and Control Wire (Underwriters' and N.E. Code, Type AVA) meet the requirements for severe service. Maximum operating temperature rating 110° C. (230° F.) For samples, catalog, and recommendations, write nearest branch office or: Rockbestos Products Corporation, 886 Nicoll St., New Haven, Conn.

ROCKBESTOS A.V.C.
The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

Water IS *IDEAL* FOR ELECTRICAL POWER...but *NOT* for Electrical Equipment *FIRES*

THE ANSWER IS...

duGas

Fire Extinguishing Equipment

For fires in electrical equipment or inflammable liquids, duGas envelopes and smothers the flame in seconds...and it's a non-conductor. Adjacent equipment, not already damaged by fire or electrical breakdown, will not be harmed by duGas and can be put into service immediately. This is not true when water is used. DuGas stands guard for many utilities throughout the country. Names on request.

Available in Models 15 and 30 Hand Extinguishers...Models 150 and 350 Wheeled Extinguishers.

Write for details and priority information.

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

REPRESENTED IN PRINCIPAL CITIES

DUGAS FIRE EXTINGUISHING APPARATUS IS APPROVED BY UNDERWRITERS' LABORATORIES, FACTORY MUTUAL LABORATORIES

with other companies in the sta New York.

Mr. Robinson is a member o American Institute of Electrical neers, the North Carolina Socie Engineering and the Raleigh Engi

•

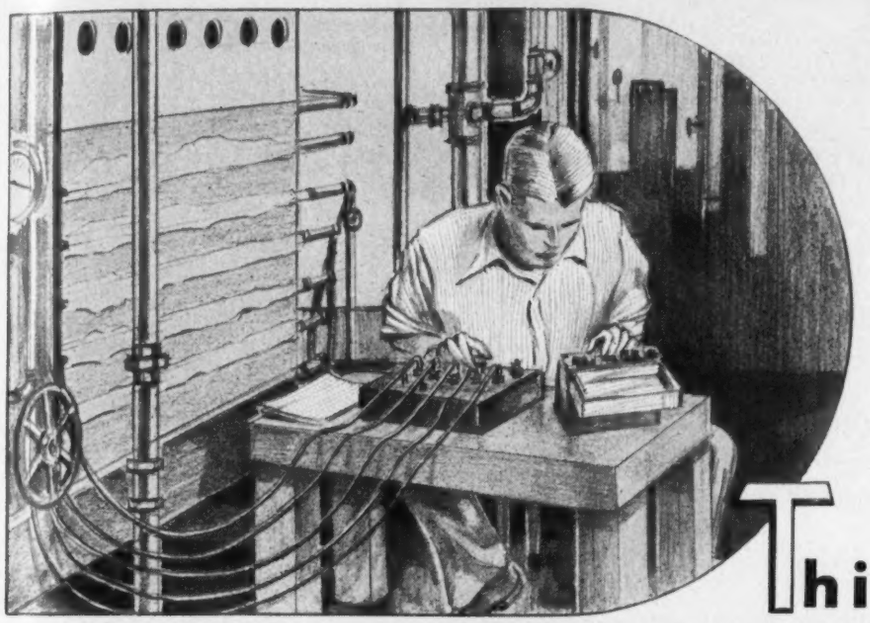
▶ E. N. Twogood has been appoi engineer of the gear department of eral Electric Co.'s Lynn Works, ceeding A. A. Ross, who has re after 48 years of service with the pany. Mr. Twogood has been exec assistant to Mr. Ross since 1923. ing retirement Mr. Ross will de part of his time to the company consultant. He is a past-presiden the American Gear Manufacturers' sociation.

▶ George E. Carpenter has b elected treasurer and assistant secre of the Westinghouse Electric Su Co. Mr. Carpenter, the company's eral auditor since the spring of 1 succeeds W. M. Dick, who resig after 40 years of service.

▶ Grant A. Wiswell of Berke Calif., has been named supervisor industrial relations for the Emeryv plant of the manufacturing and re division, Westinghouse Electric Manufacturing Co. In his new posi Mr. Wiswell will have charge of p sonnel at the plant, the division's trict headquarters. Mr. Wiswell joi Westinghouse in 1923 at Seattle, Wa soon after completing courses at University of British Columbia. 1928 he was transferred to Emeryv where he was serving as order serv supervisor at the time of his rec promotion.

▶ W. R. Frampton, manager of shop and test division of the South California Edison Co., retired recen after 37 years of service with the co pany. L. H. Beebe, Mr. Frampto assistant, veteran of 25 years of Edi service, succeeded him. Mr. Frampt joined the Edison company as a t man in 1905. With the exception about two years in distribution work, has served in various capacities in t test division since. He was made sup intendent of the division in 1914 manager of the combined shop and t division in 1928. During the past qu ter century Mr. Frampton has be prominent in national electrical circl For many years he was a member the meter committee of the Natio Electric Light Association and was o of the first chairmen of the meter co mittee of the Pacific Coast Electric Association. The watt-hour meter a its related testing facilities as incorp rated in the Edison system embo many of the principles conceived by M

Come Here for the "KNOW HOW" in Laminated Plastics!



Thirty years of concentrating the energies of a competent laboratory and research staff in the field of laminated plastics has enabled the Formica Insulation Company to introduce many new products and new applications.

Some of these are now serving important ends in the war effort—in such great volume that only a small percentage of our greatly enlarged capacity is available for the most essential civilian purposes.

War time pressure has resulted in many important steps forward in the development and applications of new ideas.

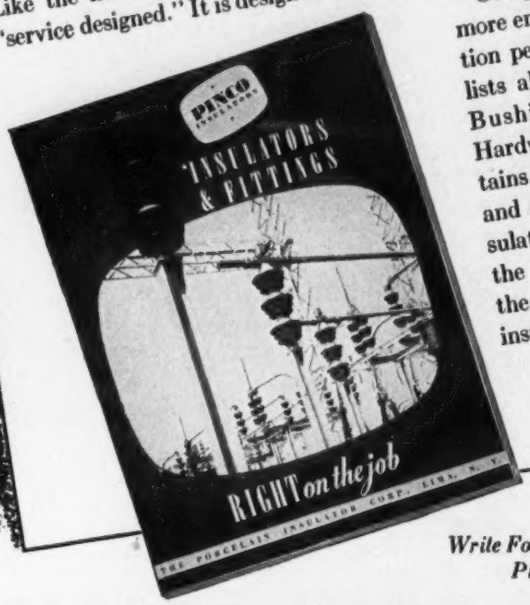
After the war these will be available for the far better and more efficient electrical and mechanical devices that everyone will be making. See us then.

FORMICA

The Formica Insulation Company
4661 Spring Grove Ave., Cincinnati, Ohio

A NEW catalog that's "Right on the Job," too

Like the insulators it catalogs, the new Pinco Catalog, just out, is "service designed." It is designed to be "Right on the Job" on your desk. Compact, file size, with more engineering information per page, it not only lists all Pinco Insulators, Bushings, Clamps and Hardware, but also contains a handy wire table and a complete list of insulator equivalents from the smallest pin type to the largest switch and bus insulators.



Write For Your Copy of the New Pinco Catalog Today.

PINCO *means Insulator service*

For twenty-three years this company has devoted its entire facilities to the design and manufacture of better insulators and line hardware. Each year has seen an expansion of those facilities. But with that expansion there has never been any growth of red tape. From design department to shipping room the entire organization is geared to "Right on the Job" service . . . the kind of service that puts Pinco Insulators, even when they have to be specially designed, on your lines when you want them.

Pinco Insulators and Hardware are cataloged in the Electrical Buyers Reference.

★ PINCO INSULATORS ★

The PORCELAIN INSULATOR CORPORATION
520 Main St. E. Lima, N. Y.

SALES AGENTS—The Joslyn Company—New York, Rochester, Philadelphia, Baltimore, Lynchburg, Va.; Jobbers Supply Co.—St. Paul, Portland, Seattle; Joslyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; Southern Joslyn Co.—New Orleans; H. E. Burns Co.—Pittsburgh; J. J. Costello—Boston; Southeast Joslyn Company—Cincinnati, Cleveland, Westerville, O., Lexington, Ky., Atlanta, Jacksonville; Paul Douden—Denver; Paul Carson—Amarillo, Texas; Joslyn Manufacturing & Supply Co.—Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Joslyn Southwest Co.—Dallas, Houston.

Frampton, especially the new sequence outdoor meter. In this arrangement the meter is installed ahead of fuses and switches, expediting meter testing and meter reading without interruption of service or other inconvenience to the customer.

▶ R. R. COWLES has been appointed assistant engineer of operation of the Pacific Gas & Electric Co. to succeed CHARLES E. YOUNG, retired. Mr. Cowles began his career with the power company in 1910, when he went to work for the Oakland Gas Light & Heat Co. During his association with P.G. & E. he has served as superintendent of the underground department in the East Bay division, as assistant engineer in the department of distribution and steam engineering and in the department of electrical construction and operation. He is well known among distribution engineers and has been active in association work. He is a past-chairman of the engineering section of the Pacific Coast Electrical Association and was general chairman of the P.C.E.A. annual convention in 1929. Mr. Cowles was also active in the old National Electric Light Association. Mr. Young had been employed continuously by Pacific Gas & Electric since 1906.

▶ JOHN J. FISKE has been named electronic control specialist for the Westinghouse Electric & Manufacturing Co. in the Los Angeles area. He became identified with Westinghouse at East Pittsburgh in 1941.

▶ C. R. VAN GORDER has been appointed district engineer for the Cardox Corp. in the New York area. The appointment of Mr. Van Gorder to the New York area was made in order to expedite the engineering service and engineering survey work in the company's expanding operations in the New York area. Prior to his New York appointment Mr. Van Gorder occupied a key position on the engineering staff of Cardox Corp. in Chicago.

OBITUARY

▶ CHARLES F. AUGUSTINE, a testing engineer for the Wisconsin Electric Power Co., Milwaukee, died suddenly on February 18, in his forty-fourth year. Mr. Augustine was connected with the utility for 21 years.

▶ JOHN J. MCHUGH, acting deputy commissioner of the New York City Department of Water Supply, Gas and Electricity, died at his home in Brooklyn, N. Y., on December 28, after a short illness. He was 56 years old. A native of Bridgeport, Conn., and a graduate of St. Francis College, Brooklyn, Mr.

It takes more than a wishbone

"If wishes were horses, then
beggars would ride"—
The truth of that proverb
cannot be denied.
And yet as you wish for
the enemies' rout—
What is it *you're doing*
to bring it about?

You've given some blood
to the Red Cross, you say,
And for the war's end,
it may be, that you pray.
And, also, perhaps, you're
an Air Warden, too—
And you work like a beaver,
the weary day through.
You save kitchen greases,
you're salvaging tin—
Good Boy! That's the spirit
that helps us to win!

It's for people like you, sir, that
these lines are meant—
Now, what about Bonds?
Do you top Ten Per Cent?

When you think of those boys
down in Guadalcanal,
(It may be among them's
your son and his pal)
Don't you ask of yourself, in
your comfortable chair,
"Just what can I do for
those fellows out there,
Who're fighting for millions
of codgers like me,
Who are too old to fight—
that *we* may stay free?"
We poorly repay them,
however we try—
But good partial payment
are Bonds that we buy!

Of none of us, may it be writ:
"This fellow did not do his bit."

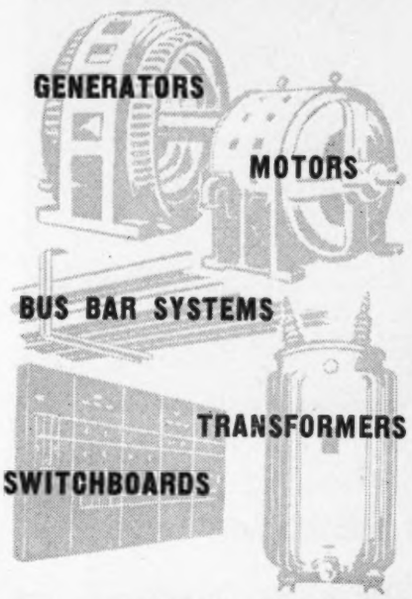
HOSKINS MANUFACTURING COMPANY • DETROIT, MICHIGAN

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

SIL-FOS AND EASY-FLO

THE LOW-TEMPERATURE SILVER BRAZING ALLOYS

are widely used in the construction of



AND A MYRIAD OF OTHER ELECTRICAL EQUIPMENT

The reasons for this wide use of Sil-Fos and Easy-Flo on electrical work are that these silver brazing alloys assure the fast production of joints high in electrical conductivity and corrosion resistance and give the strength of solid metal and the ductility to withstand severe vibration, shock and temperature changes—at surprisingly low cost.

GET DETAILS IN BULLETIN No. 12

This bulletin gives full details about Sil-Fos and Easy-Flo speed, reliability and economy—tells you how to put them to work—gives practical information on joint designing, heating methods and fast production procedures.

Copy mailed to you on request. Write today.

HANDY & HARMAN

HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE

82 Fulton St.
New York, N. Y.

Agents in Principal Cities

HANDY & HARMAN of Canada, Ltd., Toronto

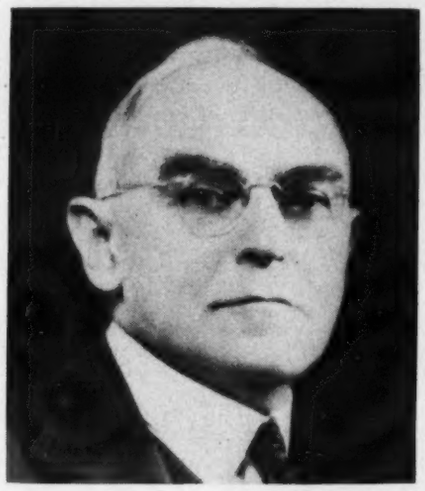
McHugh entered the service of New York City in 1907, and became a member of the Department of Water Supply in 1910. Eight years later he was made chief clerk of the Bureau of Gas and Electricity. In the fall of 1939 he was assigned the duties of chief clerk of the Department of Water Supply, Gas and Electricity and three years later became acting deputy commissioner of the department.

•

James A. Emery

James A. Emery, a vice-president and director of Ford, Bacon & Davis, Inc., engineers, New York, and well known in engineering, utility and railroad circles, died on February 23 in Montclair, N. J., after a short illness. He was 70 years of age.

In his long career as an engineer Mr.



Underwood & Underwood

Emery was in charge of much important construction work. He headed the work for Alabama utilities in connection with the TVA's purchases; he represented his firm in the recent state of New Jersey railroad tax assessment suits and in the merger of Kansas City Southern with Louisiana & Arkansas Railroad. He also served as consultant for Interborough Rapid Transit, Cities Service, Columbia Gas & Electric, U. S. Steel Corp., Standard Oil Co. (Indiana) and other corporations.

Mr. Emery was born in Biddeford, Me., in 1872 and was graduated from Massachusetts Institute of Technology in 1893. His first work was in the design and construction of electric railway properties and in 1898 he joined Ford, Bacon & Davis, becoming vice-president in 1923 and director in 1928. He was in charge of the construction of street railways in New Orleans, Atlanta and Birmingham, later being vice-president and general manager of Birmingham Railway, Light & Power Co.

for NIGHT REPAIRS *and* LINE PATROL

Linemen's Flare Lights

An efficient, economical form of portable illumination—giving daylight vision for night repairs and line patrol work. Unaffected by wind, rain or snow. Two sizes—20 or 30 minute lighting periods.

Central Linemen's Flare Lights are invaluable during outages or other emergencies when quick dependable illumination is imperative. Easily lighted in any weather by self contained friction cap. No matches required. Stick in a post, tree, cross arm, in the ground or carry by hand.

They're always ready, and provide ample illumination. Standard equipment with prominent utilities throughout the land.

STANDARD PACKING

No. 3020—20 min., per case of 72...$12.00
No. 3030—30 min., per case of 36... 9.00

Central Railway Signal Company, Inc.

272 Center Street
NEWTON, MASS.

Plant Locations: Hammond, Ind.; Needham Hts., Mass.

He was consultant to the Transit Commission, later chairman of the Transit Advisory Committee of Philadelphia in the construction and operation of Broad Street subway; a member of the State of Pennsylvania Board of Valuation Engineers; member Regional Planning Committee, Philadelphia, for airports, and in charge of engineering the starting of bus lines in New York and Chicago. Mr. Emery was the author of many articles on engineering subjects.

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Stanton Hertz

Stanton Hertz, vice-president and assistant to the president of the Copperweld Steel Co., Glassport, Pa., lost his life in a fire in his home in Pittsburgh, Pa., on February 27. A 13-year-old daughter also perished, while his wife and another daughter were critically injured.

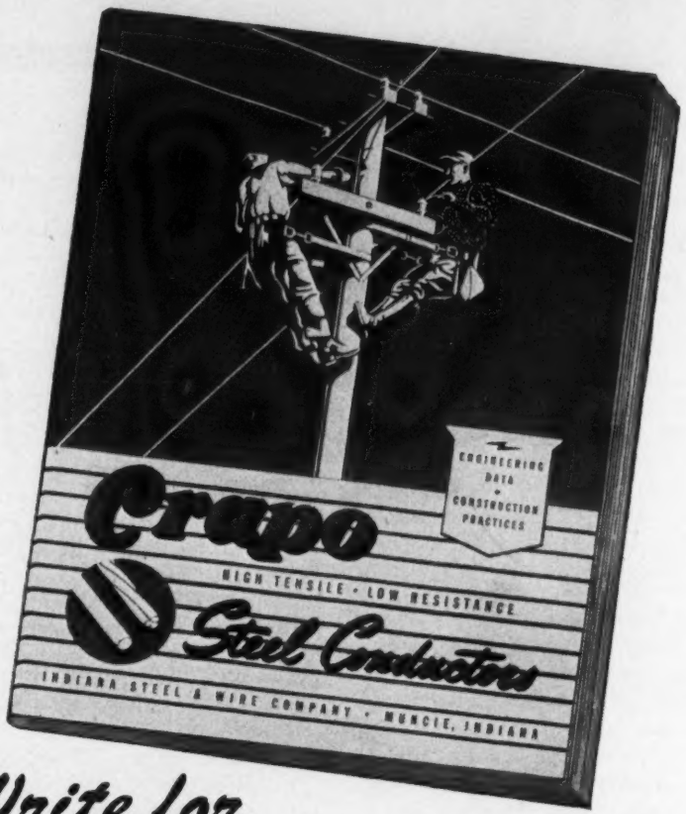
Mr. Hertz was born in Montgomery, Ala., in 1894 and was graduated from Alabama Polytechnic Institute. In 1921 he started his career with Copperweld and served successively as chief engineer at the New York office, general manager of sales and vice-president. Mr. Hertz was executive director of the Copper Wire Engineering Association for five years beginning in 1936 and on his return to Copperweld in 1941 assumed the position he held at the time of his death.

•

▶ ELMER H. SCHWARZ, consulting engineer, died at his home in Englewood, N. J., on February 21, in his sixty-third year. Mr. Schwarz was born in Rochester, N. Y., and was graduated from the Sheffield Scientific School of Yale University in 1901. He was a partner in the engineering firm of Schwarz, Hughes & McCarthy, New York. He was a member of the A.I.E.E. and A.S.M.E. and other engineering societies. He held many electrical patents.

▶ JAMES E. CHRISTY, general manager of the Jonesboro, Ark., city light and water plant until his retirement in 1929, died in a Memphis hospital on February 21. He was 79 years of age. Mr. Christy moved to Jonesboro in 1903, after having been manager of the Jerseyville (Ill.) Heat & Power Co. He entered the employ of the local power and light company and was later made manager. When the plant was sold to the city he continued as general manager. Mr. Christy was a past-president of the Public Utility Operators of Arkansas and he had also served as president of the Southwest Waterworks Association.

Specify Crapo
STEEL CONDUCTORS FOR RURAL EXTENSIONS


ENGINEERING DATA • CONSTRUCTION PRACTICES
Crapo
HIGH TENSILE • LOW RESISTANCE
Steel Conductors
INDIANA STEEL & WIRE COMPANY • MUNCIE, INDIANA

Write for
Complete Engineering Data

• Primary extensions up to 5,000 feet now may be made to "production farms" with No. 6 B.W.G. *Crapo* Steel Conductor. Such electric service connections are made possible by WPB Preference Rating Order P-46-c.

• *Crapo* Steel Conductors, with their superior 60-cycle alternating current properties and high tensile strength, are ideal for these extensions. Pertinent technical information, including the electrical characteristics and performance of these efficient and economical conductors, sag and tension data, and applicable construction practices, is available in a new and comprehensive manual. Ask representatives of Graybar Electric Company, Inc., or, write today for your copy of the *Crapo* Steel Conductor Manual!

INDIANA STEEL & WIRE COMPANY • • MUNCIE, INDIANA
Graybar Electric Company, Inc., Distributors

Crapo HTC-130 STEEL CONDUCTORS

MANUFACTURING-MARKETS

New Frigidaire Ad Campaign

The Frigidaire Division of General Motors is introducing a new advertising campaign which offers wartime help to women faced with new food and refrigeration problems, according to L. A. Clark, advertising and sales planning manager of the company.

Frigidaire's advertising theme comes from necessary wartime measures that are creating many new food and refrigeration problems. Gas rationing, for example, is cutting down store deliveries and shopping trips. Familiar foods are disappearing from retailer's shelves. Many foods are rationed and this presents the problem of storing and using meats and other foods never purchased before. Paradoxically, refrigerators are required to handle more food under wartime conditions and keep it more efficiently. Care of the refrigerator becomes more important as the burden on refrigerators increases and replacements become impossible to obtain.

Solutions to the homemaker's problems and many other suggestions on the conservation of food, care of the refrigerator, uses of food and meal planning are offered in the new Frigidaire advertising, prepared in cooperation with the food editors of leading women's magazines.

"One of the distinguishing features of this wartime advertising," Mr. Clark said, "is the way it provides for active dealer participation, thus helping the dealer to maintain his identity with Frigidaire and build good will in his community. Key feature of the dealer tie-in is an invitation in every advertisement to visit the local Frigidaire dealer to secure a free copy of the 'Wartime Suggestion Booklet' which the dealer receives without charge."

Summarizing the objectives of the new campaign, P. M. Bratten, general sales manager of the company, said "Our new program has been designed to cooperate with government nutrition and conservation programs; to render a real and needed service not only to the millions of Frigidaire users but also to the users of other refrigerators."

FRIGIDAIRE AD DRIVE—L. A. Clark, Frigidaire's advertising and sales planning manager (right), reviews with P. M. Bratten, general sales manager, the charts used to present the highlights of the new advertising program to Frigidaire's distributing organization

Patent Offer Made by General Cable

General Cable Corp. has offered the government, for the duration, a royalty-free license under all its patents covering numerous types of wires and cables vital to the war, Dwight R. G. Palmer, president, has announced. The corporation holds more than 200 patents, covering numerous types of wires and cables vital to the war effort.

Under the terms of the offer it was stated that the government would be enabled to place orders with concerns having manufacturing capacity, regardless of whether or not they are licensed. Mr. Palmer added that this will open up new outlets for the arms of the military services whose wire and cable requirements have been rising steadily.

In addition, considerable sums of money will be saved in the purchases of vital wiring, since royalty payments by General Cable licensees fulfilling war orders no longer will be required, and the resulting saving will be passed on in full to the government.

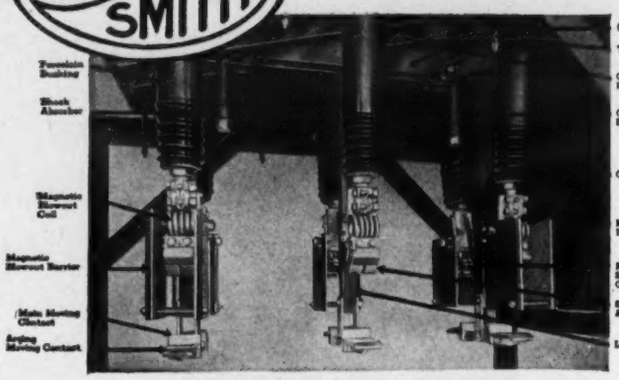
"When the government accepts the offer," Mr. Palmer said, "General Cable will notify all its licensees that they no longer continue royalty payments, provided that the government is given the full financial benefit of the savings to the manufacturer."

Despite the fact that acceptance of the General Cable offer will result in the loss of royalty income formerly devoted to research and development, Mr. Palmer declared "the corporation is increasing its expenditure for research and development of new products in furtherance of the war effort."

Get the latest Data

ROLLER SMITH

Oil Circuit Breaker in Service



Close-up of Breaker—Showing Contact Construction

OIL CIRCUIT BREAKERS

How these Oil Circuit Breakers, and other R-S Products, can save money in operating efficiency and lower maintenance costs on your system, is fully revealed in the Loose-Leaf Data Book containing all ROLLER-SMITH Catalogs.

On this page we can only hint at the merit of design and operating characteristics. For instance, the sketch above shows the rugged character of the contact construction in R-S Classes 50-OC-150 and 100-OC-150 weatherproof Oil Circuit Breakers.

For manual, electrical or reclosing operations. Handle 600 amperes at 15,000 volts, continuous rating. Interrupting capacity of the "50" breaker is 50,000 KVA, while the "100" is rated conservatively at 100,000 KVA. Conform fully to A.I.E.E. and N.E.M.A. specifications.

A comprehensive line of indoor and outdoor Oil Circuit Breakers with rupturing capacities to 250,000 KVA also are described in the DATA BOOK.

AIR CIRCUIT BREAKERS

For safeguarding lighting and power circuits in industrial buildings and for low-voltage station auxiliaries, Air Circuit Breakers afford sure protection against overloads and short circuits. They also serve to open the circuit in case of undervoltage, and, in D.C. circuits, protect against reverse current.

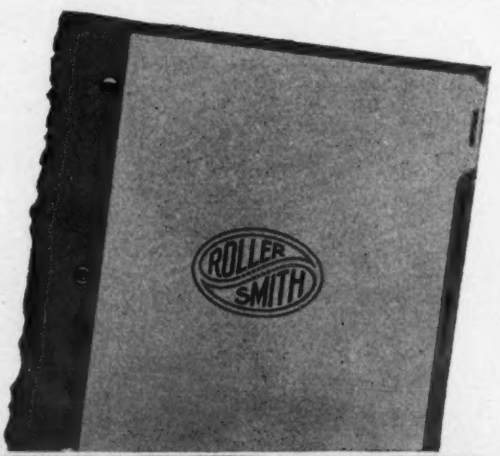
Silver to silver contact construction and an efficient arc-quencher are among many exclusive features. See Catalog 2150 — or send for complete Data Book.

METAL CLAD SWITCHGEAR

The "horizontal drawout" feature permits the removal of oil circuit breaker and disconnecting devices, and the insertion of a new unit within a few minutes time. It can't be withdrawn while in the operating position — a safety factor.

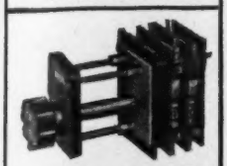
See the R-S Data Book.

This complete and Convenient Loose-Leaf Data Book is sent FREE. Please write on your Company letterhead.



SOME OTHER ROLLER SMITH PRODUCTS

Instrument and Control Switches



Thermo-Magnetic Relays for Motor Control

Circuit Testers Inexpensive — Reliable

Graphic Instruments (switchboard or portable)

ROLLER SMITH

Electrical Measuring and Protective Apparatus

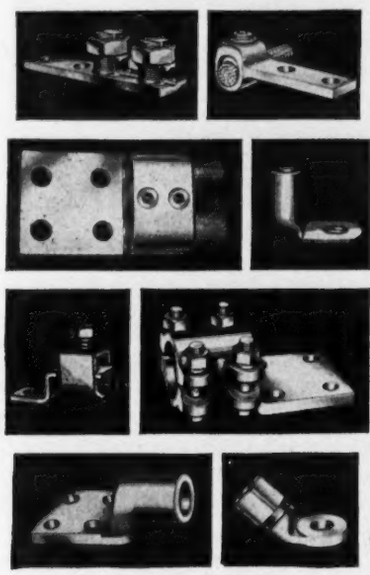
ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

"To get the **RIGHT** lug at every point—

—select your terminals from the **COMPLETE** line"

Look in the Penn-Union Catalog—all of the good types: Solderless lugs to grip the conductor by Bolt, Screw, Post-and-Nut, or Multi-Slit Tapered Sleeve . . . Soldering lugs, Cast and Stamped, in wide variety . . . Here are just a few:



You will also find the most complete line of Cable Taps, Tee Connectors . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Service Connectors.

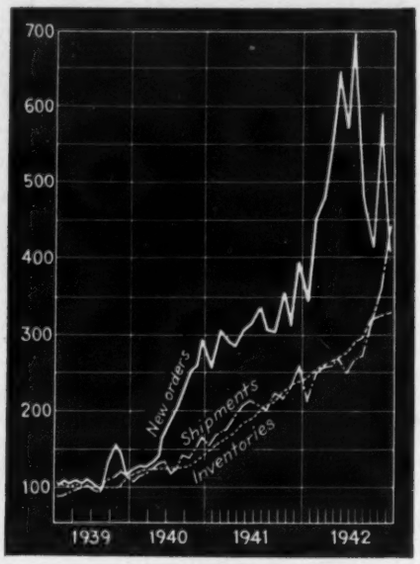
Penn-Union fittings are preferred because every one is mechanically and electrically *dependable*. They are the first choice of leading utilities, industrials, electrical manufacturers, contractors. *Write for the Penn-Union Catalog.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Electrical Machinery Shipments Advance

Substantial advances featured the movement of manufacturers' shipments in December, according to the figures compiled by the Bureau of Foreign and Domestic Commerce. Following the general trend, the index of electrical machinery shipments soared to 440 from 351 (revised) in November. This compares with 260 in December, 1941.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

New orders for electrical machinery received during the month of December declined sharply, the index dropping to 410 from 586 (revised) in November, as compared with 396 in December, 1941.

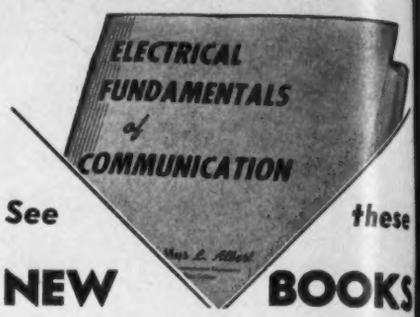
Electrical machinery inventories index turned upward to 328.7; November, 326.1; December, 1941—234.1.

•

New Orders in '42 Total $3,877,702,020

Value of new orders booked for electrical goods during the fourth quarter of 1942, as reported by 78 manufacturers, amounted to $1,095,564,623, as compared with $965,119,984 for the third quarter of 1942, and $583,213,580 for the fourth quarter of 1941, according to statistics that have been released by the Bureau of the Census, Department of Commerce.

The total value of new orders booked during the year 1942 amounted to $3,877,702,020, compared with $2,348,031,251 for 1941, an increase of 65.1 percent.



See these **NEW BOOKS**

10 DAYS FREE

1. The ELECTRICAL FUNDAMENTALS of COMMUNICATION

A clear, practical explanation of the fundamentals of electrical engineering upon which communication is based. Starts with electronics, explains what the communication technician wants to know about direct current, conductors, resistors, insulators, the magnetic field and inductance, and the electric field and capacitance—all solely from the point of view of the communication industry. By Arthur L. Albert, Purdue U. $3.50

2. MATHEMATICS for ELECTRICIANS and RADIOMEN

Out of the U. S. Navy Radio Materiel School at Anacostia Station comes a complete home-study text that teaches you mathematics from elementary algebra through quadratic equations, logarithms, trigonometry, plane vectors and elementary vector algebra with direct applications to electrical and radio problems. Gives 600 illustrative problems worked out in detail, and over 3000 practice problems with answers for checking. By Nelson M. Cooke, Chief Radio Electrician, U. S. Navy. $4.00

3. AMERICAN ELECTRICIANS' HANDBOOK

This famous handbook is packed with the facts which every man engaged in electrical work must have constantly at hand. From clear explanations of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information helps practical electrical men select, install, operate, and maintain commercial electrical apparatus and materials intelligently and with high efficiency. By Terrell Croft, revised by Clifford C. Carr. $5.00

4. The LINEMAN'S HANDBOOK

That transmission line fact you want is in this great manual of principles, data, methods, and cautions on all aspects of the lineman's work. Everything is covered, from the elements of electricity to maintenance of lines and first aid work. The writing is clear, simple, understandable. The treatment is complete, backed up with many illustrations, tables, diagrams, charts, and other explanatory and reference aids. By Edwin Kurtz, U. of Iowa. $4.00

5. FLUORESCENT LIGHTING MANUAL

This practical manual covers fluorescent lighting in all its aspects in an easy-to-understand manner. Gives the most authoritative data available on construction and performance of all types of fluorescent lamps, principles and methods of calculating illuminating requirements and designing luminaires and installations, pointers and methods of installing and maintaining fluorescent lamps and of locating and remedying their troubles. By Charles L. Amick, General Electric Co. $3.00

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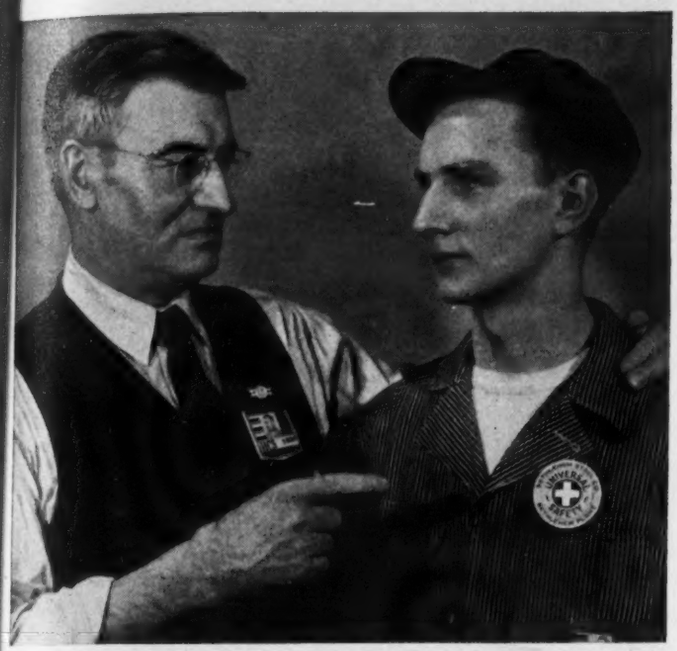
Address .....
City and State .....
Position .....
Company .....W. 3-6-43

SAFE WAYS IN WAR PRODUCTION

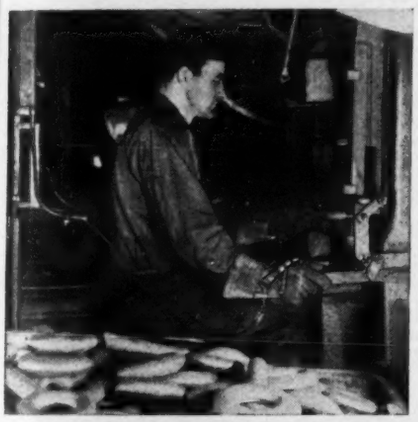


NEW WORKER—Every new employee in a Bethlehem Plant wears this button. It helps to fix his attention on safety. It signals to more experienced employees that he is new to the plant, and they keep an eye on him, and do not hesitate to offer friendly guidance in case he forgets instructions and unknowingly breaks any safety regulation.

Industrial accidents, bad enough because of the human distress they cause, are also a grievous drag on production. Every day that injury lays up a worker means lowered output of the materials our armed forces are asking for.

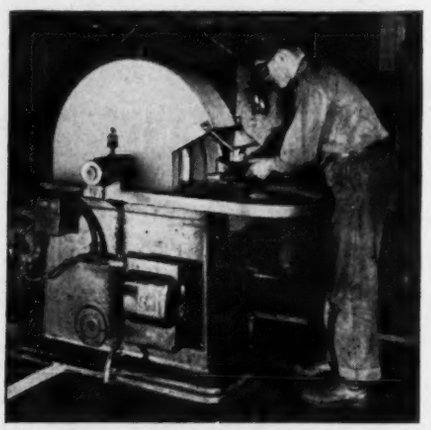
Safety engineers know they must be more than ever on guard as pressure for production intensifies and men work against time. When war came, Bethlehem Steel Company expanded its accident-prevention program to meet the new conditions. Special efforts were addressed to the new employee to make him safety-conscious from the moment he walked into the plant. And by posters, group meetings and individual instruction, the safe way of doing his job was ground into the subconscious of new Bethlehem employee and veteran alike.

Significant are the results of a current study, showing that of all disabling accidents to Bethlehem employees less than one-third occur in the course of their work. Even with employment rolls upped by the tens of thousands and plant operations at top speed to meet the demands of the war program, the Bethlehem employee is safest, best protected against injury, during the hours he spends on the job.



AUTOMATIC HAND GUARD—This man is operating a trimming press. If he should absent-mindedly let his hands move too near the danger zone, the two cables will automatically whisk them back to safety, before the ram of the press descends.

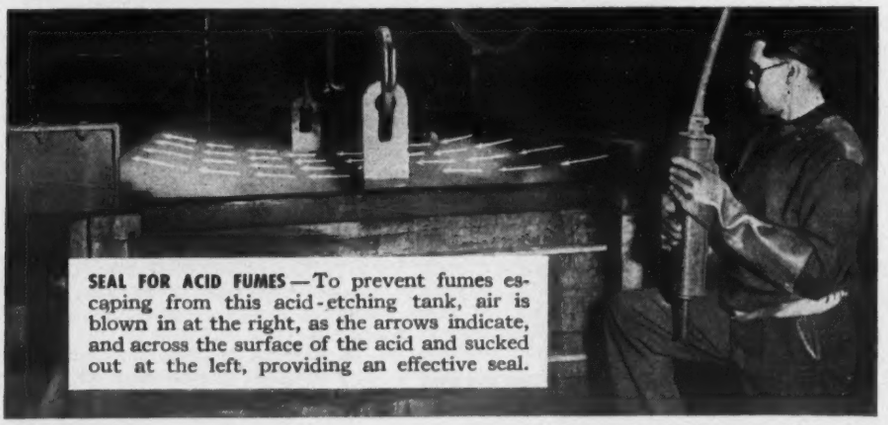
100% HEAT-INSULATED—Asbestos-covered hood, chrome-leather full-length apron, chrome-leather gloves, chrome-leather full-length sleeves and asbestos guard on torch handle give this worker complete protection against heat and flying sparks.



EYES DOUBLY GUARDED—Even though this grinder is equipped with a heavy glass shield, the eyes of the man who is operating it are given further protection against sparks or flying bits of abrasive by the cup goggles that he is wearing.

BETHLEHEM STEEL

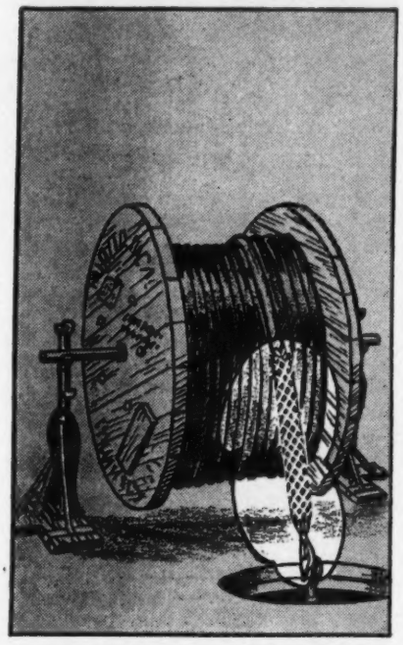
Bethlehem Steel Company is actively supporting the National Safety Council in its campaign against accidents in war production, through the War Production Fund to Conserve Manpower.



SEAL FOR ACID FUMES—To prevent fumes escaping from this acid-etching tank, air is blown in at the right, as the arrows indicate, and across the surface of the acid and sucked out at the left, providing an effective seal.

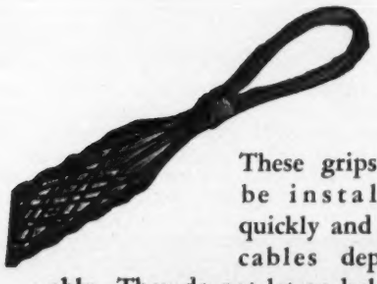
SPEED

CONSTRUCTION and EXPANSION of PLANT FACILITIES



RELIABLE CABLE GRIPS

For Pulling in Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

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Field Reports on Business

Heavy electrical equipment buying is at a slow pace; small motors and control apparatus is moving steadily; radio and communications apparatus continues buoyant. Retail buying spurt has diminished, but department store sales are still well ahead of last year.

NEW YORK

The New York stock market started the week auspiciously with the greatest volume of trading in over a year—2,000,890 shares—but prices showed signs of definitely weakening. Greatest activity was registered in pivotal and bankrupt blocks of stocks, which moved in large parcels. A good deal of the activity was ascribed to increased purchasing power of the public, which also made itself felt in one of the greatest unseasonal retail buying waves of late years.

The Federal Reserve Board announced that department store sales nationally for the week ended February 20 were 32 percent above the corresponding week last year. The week previous they were up 45 percent. Threats of rationing and the imminent imposition of the point-rationing system sent the public scurrying to the shops at a time when retail trade is usually at a fairly low ebb.

Civil engineering construction volume, however, reflected a far different picture, bearing out the estimates made prior to the first of the year that heavy construction programs for both war and industrial needs had already been pushed toward virtual completion and that a drastic falling off in new building was in prospect for 1943. Figures for the week ended February 25 totaled $54,646,000—80 percent below the volume reported for the corresponding week in 1942, according to *Engineering News-Record*. Figures for the latest week compared with even the previous week's volume—$98,861,000—show a sharp decline. Current week's construction brings the 1943 total volume to $533,068,000—53 percent below last year's nine-week period.

NEW ENGLAND

Conflicting opinions regarding the vitality of the electrical market voice present trends here as follows: Compared to 1942, heavy electrical equipment buying is at a slow pace, but small motors and control apparatus are moving steadily toward the machine tool builders. Special electrical apparatus, much of it related to radio and communications fields, is very buoyant and is one of the most active lines at present. In the field of ceramics materials with high insulating and refractory qualities, applications are becoming more numerous and negotiated contracts are following in encouraging numbers. Contracts have been closed involving more than $30,000 by one distributor; negotiations are under way for commitments involving similar amounts in connection with radio communication installations. Last week a switch and control order amounting to more than $25,000 was placed for a new war plant, and about $15,000 in control apparatus was booked by a Massachusetts plant.

Electric heating filaments are selling well. Acme Electric Heating Co., Boston, recently participated in a large government order for these. Electric Soldering Iron Co., Deep River, Conn., has been awarded an unspecified number of soldering units. Bidding on sterilizers and water heaters is quite active.

Awards by the Navy amounting to more than $500,000 in machinery involving electrical motors and control were announced last week for Worcester, Mass., machine tool manufacturers. Electric cable contracts averaging $5,000 to $10,000 have been received by Connecticut and Massachusetts manufacturers during the past fortnight. Connecticut plants have bid on pulling grips, ventilating apparatus and large amounts of condenser tubing. More than 2,000,000 pairs of Navy shoes were contracted for in the Brockton, Mass., district during the past week.

PACIFIC COAST

Pacific Coast wholesalers and manufacturers again worked large crews during the February 27-28 week-end to handle government contractor requirements of certain critical items, which orders had to reach the factories before March 1 to insure shipment before 1944. Orders received for such lines as tools, meters, fans and motors ranked with those of early February.

Tacoma is purchasing carrier telephone equipment for its new Nisqually lines, San Francisco is in the market for wire and pole line material for its Hetch-Hetchy system and Los Angeles bought Moloney transformers and a 2,000-amp. Kelman circuit breaker. Outstanding business recently booked and now under factory construction covers many main and emergency switchboards for cargo carriers; main drive and motor-generator equipment, costing $300,000, for a California steel mill; $20,000 of G.E. 800-amp. breakers for overseas shipment; three 300,000-kva. transformers, costing approximately $750,000 for a northern California utility; a 2,520-kva. capacitor, costing $105,000, for a Kaiser concern, and $30,000 switchgear equipment for Bethlehem Steel.

CHICAGO

An even 100 war orders aggregating in excess of $4,000,000 were awarded to 73 Chicago firms during the week ended February 25, according to the Chicago Association of Commerce. Of these, six were construction contracts totaling upward of $260,000 and the balance was for manufactured goods. Nine concerns received their first war orders this week.

Electrical switchgear manufacturers in Chicago report utility buying stable but at low levels. Greatest demand is for switchgear for industrial plants in the 2,300 to 15,000-volt classification. Orders for outdoor switches is practically nonexistent, one manufacturer stated. Demand for heavy electrical equipment started falling off in October, it is stated, and is conservatively estimated at 50 percent of last year's volume.

Cardox Corporation was awarded an additional $100,000 by the Defense Plant Corp. for additional facilities in Oklahoma bringing the over-all commitment to $1,175,000. Tantalum Defense Corp. was granted an increase of $60,000 for equipment in a plant in Illinois, bringing its total commitment to about $4,225,000.

The retail buying rush, touched off by shoe rationing, diminished this week in Chicago, but was not halted. Chicago department store sales were up 34 percent for the week ended February 20 over the same week a year ago.

Sales Opportunities

MARYLAND—Navy Department, Washington, D. C., plans new air base for training of midshipmen in aeronautics, comprising hangers, shops, warehouses and other industrial structures, with installation of machinery and electrical equipment. Electrical distribution system will be constructed for light and power service, with power substation facilities. Entire project is estimated to cost close to $10,000,000. Proposed to carry out work soon.

NEW YORK—General Motors Corp., Detroit, Mich., plans expansion in plants for production for government, including new buildings and installation of machinery and electrical equipment. Entire project will cost about $5,600,000, with financing by Defense Plant Corp.

WASHINGTON — Department of Public Utilities, Tacoma, plans new 13-kv. transmission line from connection with local power substation of Bonneville system to an industrial plant in vicinity of city for power supply. Purchase of materials has been authorized by City Council.

NEW MEXICO—U. S. District Engineer Office, Albuquerque, has approved plans for new airfield, comprising hangars, shops and other industrial structures. Machinery and electrical equipment will be installed. A power substation will be constructed, with electrical distribution system and control house for airfield lighting service. Entire project is reported to cost over $900,000. Award for buildings has been made to Skousen Brothers, Springer Building, Albuquerque.

CALIFORNIA—Douglas Aircraft Co., Inc., Santa Monica, plans expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment. Cost estimated at $3,890,000, with financing through Defense Plant Corp.

PENNSYLVANIA—Johnstown Traction Co., Johnstown, has plans maturing for extensions in power substation, including installation of a new motor-generator set, controls and auxiliary equipment.

IOWA—Grain Processing Corp. of Iowa, Inc., Muscatine, recently organized, is completing plans for new commercial alcohol plant. It will consist of several one and multi-story buildings, with machinery and electrical equipment for an initial plant rating of 8,500,000 gal. per annum. Cost close to $1,000,000, with financing by Defense Plant Corp. Smith, Hinchman & Grylls, Marquette Building, Detroit, Mich., are architects and engineers.

FLORIDA—War Department has authorized new air force base, comprising hangars, shops, warehouses and other industrial buildings, with installation of machinery and electrical equipment. A power substation will be built, with electrical distribution system for airfield, industrial and residential service. Entire project will cost about $5,000,000 and will be supervised by U. S. District Engineer Office, Jacksonville.

TEXAS—U. S. District Engineer Office, Fort Sam Houston, has approved plans for extensions in electrical distribution lines with service facilities for government developments in two counties. Work will be carried out at once. No estimate of cost announced.

WASHINGTON—Boeing Aircraft Co., Inc., 7755 East Marginal Way, Seattle, plans

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Nicopress Sleeve for Line Wire

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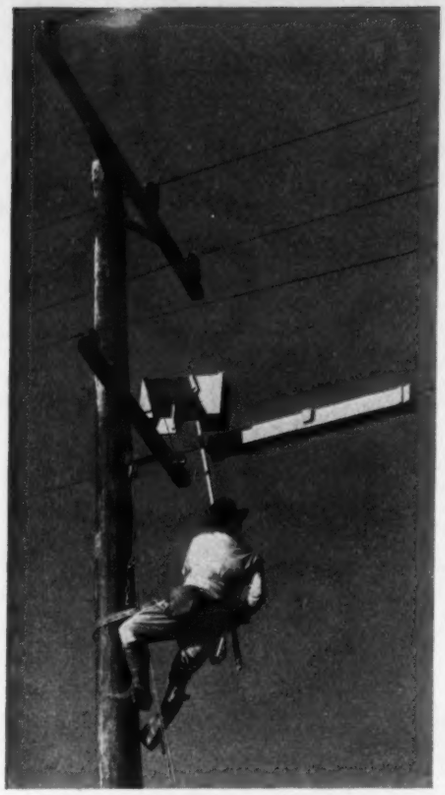

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Hoods are made for double or single arm construction having one or two insulators of, not to exceed 9" in diameter.

expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment. Cost estimated about $2,300,000, with financing through Defense Plant Corp. Work is scheduled to be carried out at early date.

WASHINGTON—Board of Kittitas County Commissioners, Ellensburg, has plans nearing completion for expansion in airport, including hangars, shops and other buildings, with electrical equipment. Work will include extensions in distribution lines, lighting system, control station and other facilities. Entire project will cost $653,365, in which amount federal funds have been authorized. Work will be carried out under direction of U. S. District Engineer Office, Seattle.

TEXAS—Consolidated Chemical Industries, Inc., Texas Division, Petroleum Building, Houston, manufacturer of acids, etc., plans expansion in plant in vicinity of city, comprising several new one and multi-story buildings, with processing machinery and electrical equipment. Cost estimated close to $1,000,000. Work is scheduled to begin soon. Chemical Construction Corp., 30 Rockefeller Plaza, New York, N. Y., is consulting engineer and will supervise erection.

CONNECTICUT—New York, New Haven & Hartford Railroad Co., New Haven, will proceed with work at once on expansion in steam-electric generating station. Additional equipment will be installed for increased capacity. Cost reported close to $500,000. Gibbs & Hill, Inc., Pennsylvania Station, New York, N. Y., is engineer.

MINNESOTA—Water Department, South St. Paul, plans installation of motor-driven pumping machinery, controls and auxiliary equipment in proposed new municipal pumping plant for water service. Application has been made for a priority rating. No estimate of cost announced. R. C. Munson, City Hall, is city engineer.

CALIFORNIA—Rohr Aircraft Corp., Chula Vista, plans expansion in airplane-manufacturing plant for production for government, including new buildings, with machinery and electrical equipment. Entire project will cost about $640,000 and will be financed by Defense Plant Corp. Proposed to carry out work soon.

WASHINGTON—City Council, Seattle, has disposed of a bond issue of $7,000,000 for expansion in municipal light and power system, including construction of concrete arch dam and development of site for hydroelectric power development, as well as other extensions and improvements. Work will begin at early date on second step of Ross power dam, part of above mentioned project, for which an AA-4 rating has been given by WPB.

OHIO—Copperweld Steel Co., Warren, has approved plans for new additions to mill, comprising series of eight one and multi-story buildings, with installation of machinery and electrical equipment. Cost estimated over $5,000,000. Erection contract has been let to Gillmore-Carmichael-Olson Co., 1873 East 55th St., Cleveland, and work will begin soon.

TEXAS—Navy Department plans conversion of an airport into a naval air patrol base, to include hangars, shops and other structures, with electrical equipment. Also, power substation unit and electrical distribution lines, with airport lighting system, control station and other facilities. Cost about $760,000. Proposed to begin work at early date.

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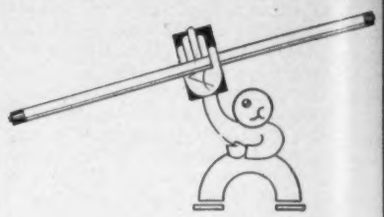

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Recent Legislation

The following measures of interest to electric light and power companies have recently been introduced in the Legislatures of various states:

INDIANA—House bill would amend the utilities act to authorize the board of directors of a municipally-owned and operated utility to provide for an employees' retirement fund and permits investment of surplus retirement funds in purchase of retirement income contracts or retirement annuity contracts written by regularly licensed insurance companies. The bill was referred to the cities and towns committee. A bill, introduced in the Senate, provides that municipally-owned utilities must require contractors to whom they make awards to pay the prevailing wage scale for common and skilled labor. The bill carries an emergency clause and if passed would be in effect on being signed by the Governor. The measure was referred to the committee on labor.

NORTH CAROLINA—Senate has received a bill to simplify and expedite hearings before the state Utilities Commission and to provide for judicial review of rules, regulations, and decisions of the commission. The measure authorizes officials of the commission, in hearing cases, to relax rules of evidence in respect to authentification or identification of letters, records, or documents; statements of opinion; and judicial notice, having regard to reasonable limits and to convenience, expense, availability of more reliable testimony.

OHIO—Several bills have been offered in the House to mitigate the distressed financial situation confronting local governments. One measure would permit the transfer of not more than 3 percent of the gross revenues from publicly owned utilities to the general revenue fund for current operating expenses. Plant expansion to meet war production needs, increased labor costs and increased taxes are playing havoc with public utility earnings, utility representatives told the House taxation committee recently. They appeared to protest continuation of the 65/100 of one percent utility excise tax for poor relief, which they contend would not be required in most localities.

SOUTH CAROLINA—House has denied immediate consideration of resolutions by Representative Wallace of York to establish a public utilities committee to handle measures which would expand the Santee-Cooper hydro-electric authority. No Santee-Cooper bills had been introduced, but they were expected to appear in either the House or the Senate. The resolutions were referred to the rules committee.

PENNSYLVANIA — Senator Jaspan introduced a bill providing that any public utility service being furnished by a municipal corporation beyond its corporate limits shall be subject to regulation and control by the state Public Utility Commission as to rates with the same force and in like manner as if such service were rendered by a private utility. The bill was referred to the committee on public utilities. Senator Jaspan also introduced a measure to "protect" the rates of patrons who have been transferred from one public utility to another whose rates are of a higher level for similar service. Referred to committee on public utilities. House Bill No. 12, by Representative Bentley, provides that all real estate of public utilities will be subject to taxation by political

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sub-divisions for school and relief purposes, except lines for transmission of electric power and messages (among other exemptions for other utilities) and the rights of way upon which such lines are located. Referred to committee on judiciary general. House Bill No 94, by Representative Moran, authorizes cities, boroughs, towns and townships to construct, acquire, own, operate, control, sell, and lease facilities for the production, generation, transmission, distribution or furnishing of electricity (and other public services as gas, steam, water) to the public within or beyond their corporate limits; confers the power of eminent domain; provides for and authorizes the incorporation and election of a board of directors to operate and manage such works. Referred to committee on municipal corporations. House Bill No. 101, by Representative Greenwood, provides that any person or corporation furnishing electricity to the public shall be liable in action of trespass for any damage or injury in excess of $10 caused to a consumer or his property as a result of a failure or shutting off of service. Referred to committee on public utilities. House Bill No. 76, by Representative Hamilton, authorizes electric light plants as projects for municipal authorities. Referred to committee on public utilities. House Bill No. 160, by Representative Bentzel, includes among the authorized "projects" of Authorities electrical plants and includes such plants and facilities among those which may be transferred or leased to Authorities by public or private owners. Referred to committee on public utilities. Legislation to extend from five to ten years the maximum length of contracts for electrical service which counties of the second class may enter into with producing companies for street and highway lighting purposes has been introduced in the House. The bill was referred to the committee on townships.

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Recent Rate Changes

UTAH PUBLIC SERVICE COMMISSION hearing on rates charged by the Utah Power & Light Co. has ended. The hearing, which opened on November 16 and recessed on December 1 until January 6 has required 36 days. The commission will not act on the complaint for at least 40 days as both sides have been allowed 30 days to file briefs and another 10 days to reply. Appreciation for the "able and untiring efforts" of counsel and the officials of the company and its staff, counsel for the commission and staff members, the witnesses, reports

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Grip will withstand a tensile strain on the cable equal to its rated strength without injury to either the core or the aluminum strands. Easily attached. Capacity No. 4 to 4/0 Solid Core.

★ WRITE FOR BULLETIN 12-A ★

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Solderless Terminal Lugs and Connectors
S. E. VINE AT THIRD • CINCINNATI, OHIO

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Mill Supply Distributors are specialists in keeping our war plants supplied with the necessary tools and equipment to help them in turning their wheels for All-Out Production.

They will always be ready to show you the advantages of Coffing Hoisting equipment.

Illustrated is Model AG "Safety-Pull" Ratchet Lever Hoist.

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COFFING HOIST CO.

Manufacturers of
Ratchet Lever, Spur Geared, Electric and Differential Hoists
Trolleys
Utility Maintenance Tools
DANVILLE, ILLINOIS

d their staff in compiling the record, hich reflects the evidence from which problem before us must find solution," s expressed by George S. Ballif, chairn of the commission.

NEW LISBON MUNICIPAL electric utility s been directed by the Wisconsin Public rvice Commission to reduce rates apoximately $3,400 a year.

PORTLAND GENERAL ELECTRIC CO. direcrs have voted unanimously to stand by eir previous offer to supply State instiions with electric energy at 8.5 mills a ilowatt-hour and to reject the state's ounter-proposal of a rate of 7.5 mills a ilowatt-hour. Negotiations between the ate board of control and representatives f the company have been in progress since contract between the state and the comany expired last July. Under mutual greement, state institutions have continued o receive energy under terms of the old ontract.

•

REA Allots $409,050 for War Service

The Rural Electrification Administration recently announced allotments totaling $409,050 to sixteen rural electric systems in twelve states to enable existing REA-financed systems to provide electric service to several important war establishments.

Administrator Harry E. Slattery, in announcing the loans, pointed out that no new construction will be undertaken except in accordance with authorization or regulation of WPB.

Details of the allotments are as follows:

COLORADO—Union Rural Electric Assn., Inc., Brighton, John G. Kalcevic, supt., $10,000 to reimburse member connection fund.

GEORGIA—Flint Electric Membership Corp., Reynolds, L. C. Woolard, supt., $41,000 to extend service to a defense housing project and reimburse the member connection fund.

ILLINOIS—Southeastern Illinois Electric Cooperative, Inc., Harrisburg, A. F. Lentz, mgr., $16,000 to provide substation facilities and reimburse member connection fund. Tri-County Electric Cooperative, Inc., Mt. Vernon, B. H. Tuttle, supt., $30,000 to reimburse member connection fund.

MINNESOTA—Itasca-Mantrap Cooperative Electric Assn., Park Rapids, R. W. Wright, acting supt., $20,000 to reimburse member connection fund.

MISSISSIPPI—Singing River Electric Power Assn., Lucedale, F. S. Truax, supt., $20,000 to reimburse member connection fund. Southern Pine Electric Power Assn., Taylorsville, H. L. Pickering, supt., $40,000 to extend service to pumping station on new oil pipeline.

MONTANA—Yellowstone Valley Electric Coop., Inc., Huntley, Max Mathews, mgr., $10,000 to reimburse material-labor account and general fund.

NORTH CAROLINA — Roanoke Electric Membership Corp., Rich Square, $12,000 to provide funds for right-of-way clearance.

TENNESSEE—Tri-County Electric Membership Corp., Lafayette, Will Hall Sullivan, supt., $40,000 to reimburse member connection fund.

TEXAS—Victoria County Electric Cooperative Co., Victoria, S. W. T. Lanham,

skilled hands and willing hearts . . .

TUNED FOR BATTLE

Advanced developments by Doolittle for critical WAR EQUIPMENT today means better communications for your peacetime needs tomorrow.

To Assure Victory Buy More U. S. War Bonds and Stamps

Doolittle RADIO, INC.

Builders of Precision Radio Communications Equipment

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Pay Out Cable Safer, Faster!

Simplex No. 322. 10 tons capacity. For reels 36" to 84" in diameter.

Simplex Cable Reel Jacks eliminate the hazard of "runaway" reels, save manpower, protect reels and cable against damage. This and twelve other types described in Bulletin "U-42." Stocked by leading jobbers.

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..., $20,000 to reimburse member con-...tion and general funds. Texas Power ...erve Electric Cooperative, Inc., Austin, ...,000 to purchase mobile generating ...ts now owned by other REA coopera-...es.

VIRGINIA—Virginia Electric Cooperative, ...wling Green, W. H. Brown, supt., $12,-... to complete office building headquar-...s. Prince William Electric Cooperative, ...nassas, J. Y. Roseberry, supt., $76,350 ...provide extension of service to military ...ablishment.

WASHINGTON—Pend Oreille Electric Co-...erative, Inc., Newport, C. G. Mott, supt., ...,000 to reimburse member connection ...nd.

WYOMING—Lower Valley Power & Light, ...c., Freedom, Easton Hood, supt., $9,500 ... reimburse general fund.

LETTER TO THE EDITOR

The Substitute to End Substitute

To the Editor of ELECTRICAL WORLD:

Your editorial in the November 14 issue of the ELECTRICAL WORLD and the subsequent comments by the readers of this magazine suggesting a "Substitute for 'Substitute'" impress me as having as little importance as President Roosevelt's recent quest for a suitable name for the present World War. The consensus at that time was that we were interested in winning the war—not finding a name for it.

In this instance we are gladly accepting "substitutes" as substitutes in order to win the war. Anything that is not a substitute must of necessity be an improvement.

My recommendation is that we all forego further New Deal thinking, accept substitutes as substitutes, improvements as improvements, leave the English language as it is and let the "substitutes" have due credit for their part in defeating our common enemies.

Swarthmore, Pa. S. B. BREWSTER

[We thoroughly agree that the comments on "Substitute for 'Substitute'" aren't getting us anywhere. At the same time the whole thing has provided an amusing interlude as well as doing what we had in mind originally—drawing attention to the implications of substitutes today.—EDITORS.]

•

Budd Induction Heating Moves into New Plant

Budd Induction Heating, Inc., a subsidiary of Budd Wheel Co., is now at full production in its modern plant in Detroit, the company has announced.

Save Time—and You Speed Up VICTORY!

Sherman Solderless Lugs can be assembled in a jiffy, and they make a tight, permanent connection! Extra thread plate for strength. Floating pressure pad attached to screw. Serrated gripping surfaces. Sizes up to 500m CM. Underwriters approved. *Write for catalog.*

H. B. Sherman Mfg. Co.
Battle Creek Michigan

Sherman Solderless Lugs

G.C.A.

Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
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Send for Catalogue

We have been making safety tools for 26 years

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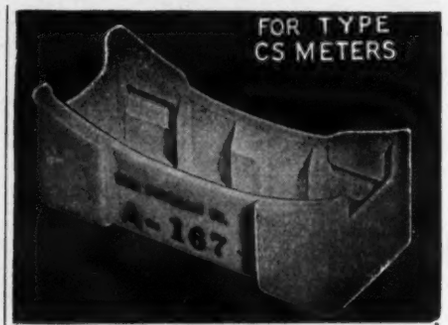

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PORCELAIN!

That means something these days when metal is so hard to get. Not only that, this seal has to be broken for the thief to tamper with the meter. Send for a sample.

Write to

STAR PORCELAIN CO.
51 Muirhead Ave., Trenton, N. J.

ACE of PLUGS!

COLOR TELLS SIZE
EASY SELECTION
QUICK INSPECTION

The shock and vent-proof top is safe—no glass to cut fingers—and their dependability means less loss of revenue.

"YOU CAN'T GO WRONG WITH COLORTOPS"

TRICO FUSE MFG. CO. Milwaukee, Wis.

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00. (See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.
PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E.W.

NEW ADVERTISEMENTS received by 10 A. M. March 15th will appear in the March 20th issue subject to limitations of space available

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 33 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVE AND TECHNICAL MEN. Qualified candidates desiring $2,500 to $20,000 position may contact employers through our confidential services, established 27 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

METER INSTRUMENT MAN—16 years training and experience in Utility field. Capable of meter department supervision. PW-508, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL AND STRUCTURAL ENGINEERS, experienced power house, substation, and transmission line designers, immediately available. Public utility engineers completing authorized construction projects will gladly arrange interviews and otherwise bring your requirements to such men's attention. PW-501, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ACCOUNTANT — Age 44, presently employed, 18 years experience includes 12 years Public Utility, Field, commercial and general. Will go anywhere. PW-514, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ENGINEERS WANTED

Electrical, Electronic, and Mechanical Engineers (men or women) with at least some development laboratory experience. Recent graduates also considered.

Old established plant located in Central Indiana, normally manufacturing precision parts for wide range of industries, including aviation, automobile and electrical. At present devoted to developing and producing war equipment.

Excellent post-war opportunities for those who qualify. If not employed in war production to highest skill, write, giving full details of experience, education, age, draft status and salary expected. Address

P-511, Electrical World
330 W. 42nd St., New York, N. Y.

UNUSUAL OPPORTUNITY

For an electrical engineer with technical education, experience and ability to develop into superintendent of operation of public utility. Must be qualified in all phases of production, transmission and distribution and have ability to supervise. Experience in town of approximately 50,000 desirable. Replies held in strictest confidence.

P-512, Electrical World
330 West 42nd Street, New York City

EXECUTIVES AND TECHNICAL MEN

We solicit inquiries from qualified candidates who desire to contact employers for positions paying from $2,500 to $20,000 per year. Confidential. Est. 28 years.
(Inquiries from Employers entail no obligation)
THE NATIONAL BUSINESS BOURSE
H. H. Harrison, Director
20 W. Jackson Blvd., Chicago

POSITIONS WANTED

ELECTRICAL ADVERTISING & sales promotion manager. Many years full charge department, electrical equipment firm. Experienced placing publicity electrical press. Novel advertising, promotion, production-stimulation ideas. Trained executive. Married 4H. Well known electrical trade executives. Gilt edged references. PW-515, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER—Design of Industrial Plants, Power Plants, Switchboards, Bus layouts, Conduit Runs, Wiring Connections. 20 years experience in charge of important work. Estimating, specification writing, field engineering, supervision. PW-516, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

WORK WANTED

MANUFACTURERS AGENTS well established in Chicago territory with warehousing, and engineering facilities, desires additional lines. PW-504, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

WANTED

WANTED By Established Electrical Manufacturer—New type electrical fittings or products in conjunction with same, that are used by Electric Utilities for post war manufacture. Patented articles preferred but not essential. W-507, Electrical World, 330 W. 42nd St., New York, N. Y.

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Immediate Delivery
TRANSFORMERS

3—General Electric Type H—250 KVA
13800 Volt Primary—4 2½% Taps
2400/4160Y Volt Secondary Single
Phase 60 Cycle with Oil

Transformers have never been used

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K.W.	Make	R.P.M.	D.C. Volts.	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200

ROTARY CONVERTERS—3 PH. 25 CY.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M.G. SETS—3 PH. 60 CY.

1—1500	G.E.	720	600	6600
1— 500	G.E.	720	600	13200

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51 Howell Street, Jersey City, N. J.

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4000 KW TURBO-GENERATOR

1—Westinghouse Electric & Manufacturing Co. turbo-generator turbine #2581, designed for 160 lbs. pressure at the throttle valve, direct connected to a generator #1,331,510, 3 phase, 60 cycle, 5000 KVA or 4000 KW at 80% P.F., 2300 volts, 3600 RPM, complete with Barometric Condenser, driven by a Terry steam turbine type C, and circulating pump, but no exciter; possibly complete with switchboard.

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GAS AND ELECTRIC DEPARTMENT
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FREQUENCY CHANGER

1400 HP 460 volts, 3 phase, 60 cycle, 300 RPM, 1570 ampere, 1250 KVA, p.f. 0.9, 50-deg. rise, type ATI-24-1250M-300 form C, with amortisseur winding; with
1000 KW 460 volts, 3 phase, 25 cycle, 300 RPM, 1570 ampere, 1250 KVA 0.8 p.f. 50-deg. rise, General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW direct-connected exciter.

CHICAGO ELECTRIC CO. 1314 W. CERMAK RD. CHICAGO, ILL.

POWER FOR PRODUCTION!

MOTORS GENERATOR SETS

—200 KW, 600 volt, GE, sq. cg.
—250 KW, 250 v., GE Synch.
—300 KW, 125 v., Wsgh., Sq. Cage.
—100 KW, 125 v., GE Sq. Cage.
—100 KW, 125 volt, Electric Products, syn.

MOTORS—3 PHASE 60 CYCLE

—720 HP, 360 RPM, 440 volt, G.E., syn.
—500 HP, 1200 RPM, 440 volt, GE, syn.
—400 HP, 514 RPM, 440 volt, Westg, slip ring.
—335 HP, 600 RPM, 2300 volt, GE, syn.
—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
—250 HP, 514 RPM, 4000 volt, G.E., syn.
—250 HP, 600 RPM, 4000 volt, G.E., Sync.
—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whir, sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sg. cg.

MOTORS—D.C. 230 VOLTS

1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

J. L. HEMPHILL & CO. PHONES
1602 53rd STREET, NORTH BERGEN, N.J.
NEW YORK: LOngacre 5-3227
NEW JERSEY: UNion 3-2600

WANTED

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Prices quoted on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

WANTED
SURPLUS TRANSFORMERS

Don't scrap transformers. You can aid the War Effort by sending your list of surplus transformers to us. As we are one of the largest rebuilders and rewinders of transformers in the U. S. we can offer you top prices. Please give complete nameplate details and condition of transformer whether in operating condition or burnt out.

1893—Celebrating Our 50th Anniversary—1943

GREGORY ELECTRIC CO.
2636 S. WABASH CHICAGO

CHECK OUR STOCK!

TRANSFORMERS
MOTORS
AC-DC—25 and 60 cy.

SPECIALS

2—500 HP Westinghouse Slip Ring Motors 3 PH. 60 cy. 440 V. 600 RPM.

1150 HP. G. E. Synchronous Motor 25/3/2200/375.

GENERATOR SETS
FREQUENCY CHANGERS
GENERATORS

SPECIALS

1—100 KW Motor Generator Set, Generator 220 V DC. Motor 3/25/2200 V.

ERIE ELECTRIC COMPANY
124 Church St., Buffalo, N.Y.

FOR SALE
TRANSFORMERS

Three type SK Westinghouse, 75 KVA Transformers, 6900, 6585, 5960 volts to 460, 230 volts, 60 cycle, style number 305127. Good condition. Presently located at Casper, Wyoming.

CONTACT
Rocky Mountain Drilling Co., Box 1526, Casper, Wyoming, or at 437 So. Hill St., Los Angeles, Calif.

ADVERTISING IN THIS ISSUE

• *Here you'll find the answers to many of your questions about: What's new in the market? What products or methods will save me time and money? It's a good habit to follow the advertising pages in Electrical World each issue*

*Allen-Bradley Company 111, 112
*Allis-Chalmers Mfg. Co.....10, 11
American Tel. & Tel. Co..... 32
*Artkraft Sign Company..... 128

Barker & Wheeler..... 132
*Bell Lumber & Pole Co.....40, 41
*Bendix Aviation Corp., Marine Division 106
Bethlehem Steel Co..... 125
Black & Veatch..... 132
*Bright Light Reflector Co., Inc..... 104
Broadway Maintenance Corp..... 132

Central Railway Signal Co., Inc.... 120
*Chance Co., A. B..... 128
Cheney & Co., E. J..... 132
Coffing Hoist Co..... 130
Columbia Engrg. Co..... 132
*Continental-Diamond Fibre Co..... 36
Cooper & Co., Hugh L..... 132
*Cope, Inc., T. J..... 96
Copperweld Steel Co..... 20
Crescent Insulated Wire & Cable Co. 34

Dampney Co. of America..... 89
Day & Zimmermann, Inc..... 132
De Laval Separator Co..... 18
Delta-Star Electric Co..... 24
Directory of Engineers..... 132
Doolittle Radio, Inc..... 131
Dugas Engrg. Corp..... 116
*Dunn, Inc., Struthers..... 87

Electric Controller & Mfg. Co..... 26
Electrical Testing Laboratories, Inc. 132
Electroline Company 5
Elliott Company 6
Engineers, Directory of..... 132
Everstick Anchor Co..... 130

*Fairbanks, Morse & Co..... 37
Ferguson, H. F..... 132
Foley Construction Corp., Robert E. 132
*Formica Insulation Co..... 117
*Four Wheel Drive Auto Co..... 27
Fowle & Co., Frank F..... 132

*G. C. A. Mfg. Co..... 133
G & W Electric Specialty Co.....28, 29
*General Electric Co. 71, 72, 73, 75, 77, 95
General Electric Co., Air Conditioning and Commercial Refrigeration Dept. 8
Gilbert Associates, Inc..... 132
Gould Storage Battery Corp..... 14
Grinnell Co. 33

Handy & Harman 120
*Hazard Insulated Wire Works..... 4
Henkels & McCoy..... 132
Hoosier Engineering Co..... 132
*Hoskins Manufacturing Co. 119
Hubbard & Co..... 109

*Ideal Commutator Dresser Co..... 114
*Illinois Electric Porcelain Co..... 39
*Imperial Porcelain Works..... 130
Indiana Steel & Wire Co..... 121
*I-T-E Circuit Breaker Co...Third Cover

*Johns-Manville 12

*Kearney Corp., James R..... 13
Kelvinator Division of Nash-Kelvinator Corp. 100, 101
Kerite Insulated Wire & Cable Co., Inc. 42
Kidde & Co., Inc., Walter..... 107
*Klein & Sons, Mathias..... 97
*Krueger & Hudepohl..... 130

*Lapp Insulator Co..... 21
Leffler, William S..... 132
Lincoln Electric Co..... 91

Main, Inc., Chas. T..... 132
Manning & Co., J. H..... 132
McGraw-Hill Book Co..... 124
Mead, Daniel W..... 132
Miller Company, The..... 17
*Mitchell-Rand Insulation Co., Inc. 85
*Monitor Controller Co., The..... 103
Mullergren, Arthur L..... 132

National Telephone Supply Co..... 127
*National Varnished Products Corp., The 130

Ohio Brass Co..... 9
*Okonite Co. 4
*Okonite-Callender Cable Co.....
Osmose Wood Preserving Co. of America, Inc.....

Paragon Electric Co.....
*Penn-Union Electric Corp.....
Philco Corp., Storage Battery Div.
*Porcelain Insulator Corp.....

*Railway & Industrial Engineering Co. .....
Recording & Statistical Corp.....
*Reliable Electric Co.....
Revere Copper and Brass Inc.....
*Rockbestos Products Corp.....
*Roller-Smith Co. .....

Sanderson & Porter.....
*Sangamo Electric Co.....
Sargent & Lundy.....
Scheidenhelm, F. W.....
Searchlight Section 134, 135
Shell Oil Co.....
*Sherman Mfg. Co., H. B.....
Simplex Wire & Cable Co.....
Socony-Vacuum Oil Co., Inc.....
Standard Oil Co. (Indiana) Back Cover
*Star Porcelain Co., The.....
Stone & Webster Engrg. Corp.....

Templeton, Kenly & Co.....
Trico Fuse Mfg. Co.....

*United States Steel Corp.....
Universal Atlas Cement Co.....

Welsbach Engrg & Mgt. Corp.....
*Westinghouse Elec. & Mfg. Co. 16, 22, 23, 30, 31, 83, 99, 105
*Weston Electrical Instrument Corp. Second Cover
*Wheeler Reflector Co.....
White Engrg. Corp., J. G.....
Wiley & Sons, Inc., John.....

■

PROFESSIONAL SERVICES 132

■

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES 134
EMPLOYMENT SERVICE 134
POSITIONS VACANT 134
POSITIONS WANTED 134
WANTED TO PURCHASE.....135
USED AND SURPLUS EQUIPMENT.....130-131
Allison-Williams Co. 134
Chicago Electric Co.....134
Holyoke, City of.....134
Belyea Co., Inc.....134
Brew, Woltman & Co.....134
Electric Service Co., The.....135
Erie Electric Co.....135
Gregory Electric Co.....135
Hemphill & Co., J. L.....135
Rocky Mountain Drilling Co.....135

★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

Saving Maintenance

WITH

KLAMP-TITE SWITCHES

FIG. 1

FIG. 2

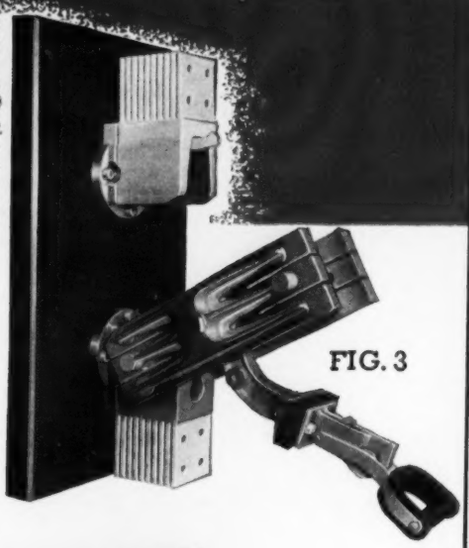


FIG. 3

A 10,000 ampere, low-voltage Klamp-Tite in closed position, Fig. 1; in closing position, Fig. 2; and in fully-opened position, Fig. 3.

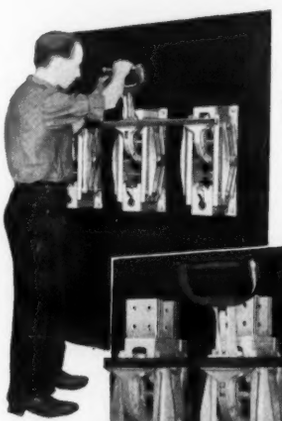


FIG. 4

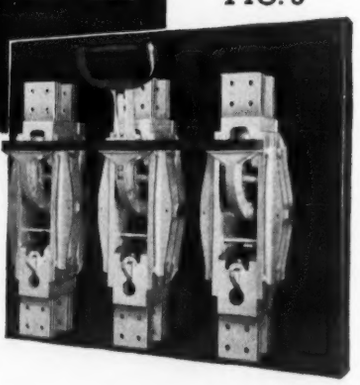


FIG. 5

WHEN a Klamp-Tite Switch is closed, contacts bear against terminals under thousands of pounds constant pressure. The surfaces, silvered and pressed together, can remain in closed position for years without maintenance.

In Klamp-Tite design, heavy bronze bars which produce positive contact pressure are located outside the current path where they are not subject to overheating and distortion.

The elements in conventional switches which make for frequent inspection and maintenance are entirely absent in Klamp-Tites. Consequently, Klamp-Tites can be depended upon to protect critical production schedules.

Klamp-Tite Switches are of many types, for service from 1600 amperes up. Figs. 4 and 5 are of 5000 and 4000 ampere capacity, respectively.

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

2 ways to clean Turbines

1 This way's always a lot of work

Safe cleaning practice. When turbines have operated on oil that has developed excessive sludge and acidity, all trace of contaminants should be removed before refilling. Any contaminants left in the system will speed up deterioration of the new oil. Here are highlights of safe practice:

1 Completely drain the system of old oil.

2 Remove the oil cooler and completely clean it of deposits and old oil.

3 Clean the oil reservoir and precipitation tanks.

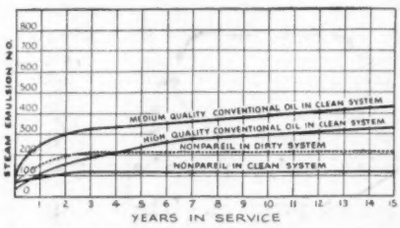
4 Remove bearing caps and end plate, and clean recesses in and around bearings and pedestals.

5 Clean screens and filter or centrifuge.

6 Examine piping layout to determine if it will completely drain. If there are low places or pockets, open up pipe joints at suitable places to insure complete drainage. If possible, pipes should be wiped by drawing rags through them.

7 Clean the governor mechanism, bleeder valve operating mechanism, and oil-operated throttle. It is usually necessary to remove hand plates to insure complete cleaning of the pockets and recesses in the governor mechanism.

All who are familiar with turbine operation know that the foregoing is a bare outline of necessary steps which involve many hours of labor and down time.



Above chart shows that the S. E. number of Nonpareil Turbine Oil remains fairly constant in service, while that of conventional turbine oils tends to increase, due to acidity and sludge. The two lower lines show the advantage of thoroughly cleaning a turbine before installing new oil.

2 This way you do the work only once

Use Nonpareil Turbine Oil, and you need clean your turbine only once—at the time of the original fill.

Why Nonpareil keeps turbines clean. Turbines need cleaning if and when they develop excessive deposits in the oil system. Basic cause of such deposits is oxidation—the absorption of oxygen by certain unstable hydrocarbons in the oil. There are two main types of these unstable hydrocarbons—one forms asphaltenes, the other organic acids.

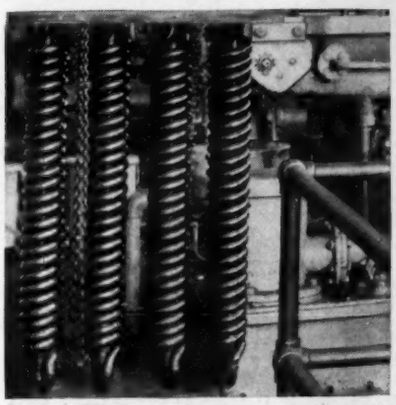
In the refining of Nonpareil, all of the asphaltene-forming hydrocarbons are removed—which completely eliminates this type of deposit. This statement can be made about very few oils.

We know of no refining process that will remove *all* acid-forming hydrocarbons. But we render them permanently harmless in Nonpareil by the addition of a patented inhibitor. This lets us guarantee the neutralization number of Nonpareil never to exceed 0.15 for the life of the turbine. In actual service, it is more likely to be around 0.05, as hundreds of turbines have proved after 5 to 15 years of operation. *This* claim can be made for *no* other oil.

Thus, with the two basic causes of deposits removed, Nonpareil stays clean—retains its new-oil condition. Use it, and you'll never again need to clean your turbines.

A Standard Lubrication Engineer will gladly furnish details, service records, and other proof. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

OIL IS AMMUNITION . . . USE IT WISELY



Unretouched photograph showing cooler coils from a steam turbine after 10 years of operation on the same batch of Nonpareil Turbine Oil without change. Note cleanliness.

★ ★

NONPAREIL TURBINE OIL

★

STANDARD OIL COMPANY (INDIANA)

★ LUBRICATION ENGINEERING